Report on International

OIL AND GAS JOURNAL

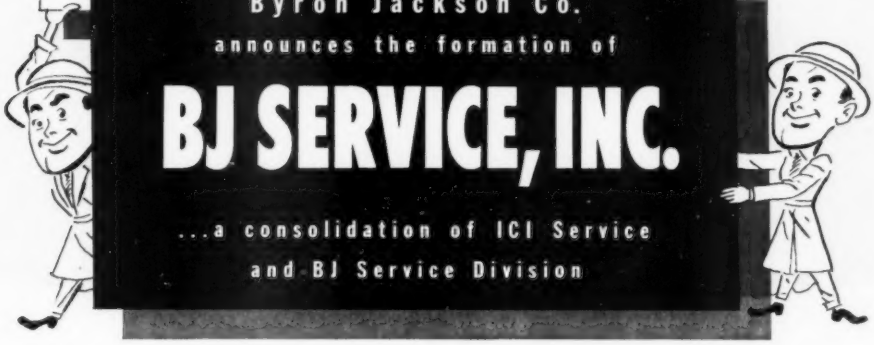
TWO OLD FRIENDS...ONE *NEW* NAME!

B J SERVICE DIVISION
and
INTERNATIONAL
CEMENTERS, INC.

Byron Jackson Co.
announces the formation of

BJ SERVICE, INC.

...a consolidation of ICI Service
and BJ Service Division



CEMENTING SERVICE
- Oil Well
- Water Well
- Plastic Cementing
- Admixtures

CHEMICAL TREATMENT SERVICE
- Oil Well
- Water Well
- Industrial & Marine Boilers, Condensers, Evaporators, Heat Exchange Equipment, Tanks & Pipe Lines

EXPORT SALES
- Cementing & Pumping Units
- Cementing Heads & Plugs
- Bulk Cementing Equipment—Transport & Storage Units
- Cement Admixtures
- Acidizing Units • Wire Line Units

WIRE LINE SERVICE
- Jet Perforating: Perfo-Jet, Strato-Jet, Pulvo-Jet
- Bullet Perforating
- Selective Acidizing
- Flow Surveys
- Caliper Surveys
- Permeability Surveys
- Pressure Surveys
- Temperature Surveys

FAST FIELD SERVICE AVAILABLE FROM THESE LOCATIONS:

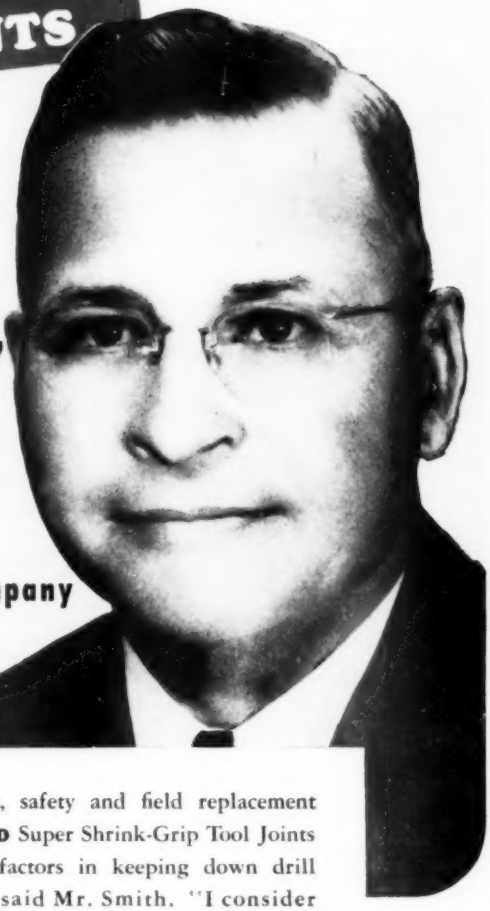
PACIFIC COAST	ROCKY MOUNTAIN	TEXAS
Long Beach	Casper, Wyoming	Odessa
Ventura	Sterling, Colo.	Seagraves
Bakersfield	Sydney, Neb.	Big Lake
Avenal	Worland, Wyoming	Rankin
San Ardo	Williston, N. D.	Hobbs, N. M.
Oakland		

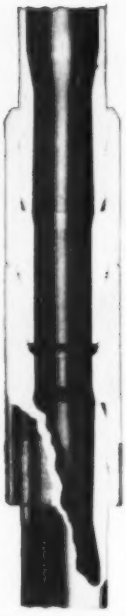
BJ Service

PRICE 50 CENTS TABLE OF CONTENTS PAGE 169 **DECEMBER 20, 1951**

REED
Super Shrink-Grip
TOOL JOINTS

"They help me keep down drill string costs"





...says V. T. Smith, Vice President of Quaker Drilling Company of Kansas

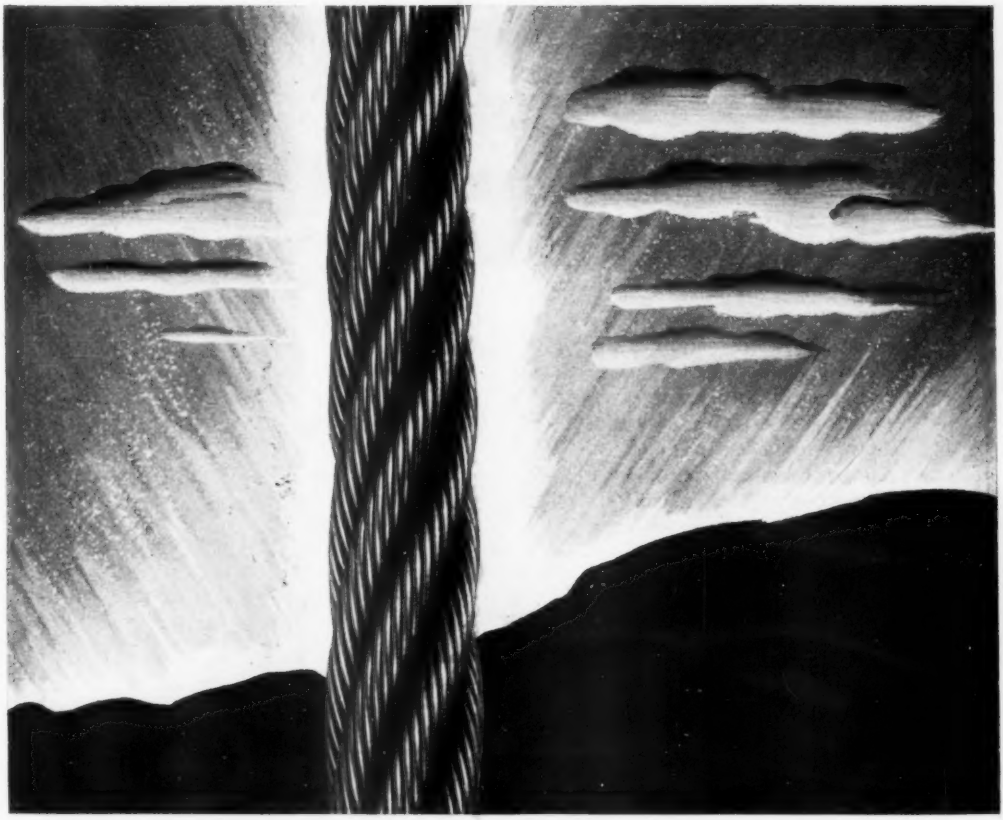
"The long life, safety and field replacement features of **REED** Super Shrink-Grip Tool Joints are important factors in keeping down drill string costs," said Mr. Smith. "I consider economies like this necessary to the successful operation of a drilling business."

REED ROLLER BIT COMPANY

HOUSTON 1, TEXAS

NEW YORK LONDON BUENOS AIRES

Gulf Coast, Mid-Continent, Rocky Mountain and Canadian Distributor for Martin-Decker Products



It Does So Much... and Asks So Little

Ever stop to think how much your Bethlehem wire rope does for you in a day's time?

Ever compute the tremendous tonnages it lifts? Or the number of heavily-loaded cars it hauls up a slope? Or the cubic yards of rock it helps dig out of the ground and move from place to place?

The work it does is pretty stupendous. Yet its demands are simple. Give it just ordinary care and you'll find it sticks with you . . . moving those tonnages week after week, month after month.

True, you have to replace it once in a while. Even Bethlehem rope won't last forever. But for every dollar it costs, it gives you in return a whopping big dollar's worth of service. You can't make a better buy in wire rope . . . anywhere.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation

When you think WIRE ROPE . . . think BETHLEHEM

GET THESE *Outstanding Features* IN YOUR NEXT DIESEL

- √ "TRUE" DIESEL OPERATION
- √ UNIT FUEL INJECTION
- √ FOUR VALVES PER CYLINDER
- √ HYDRAULIC SERVO-TYPE GOVERNOR
- √ DISTORTIONLESS PISTONS
- √ INTERLOCKING CONNECTING RODS
- √ DUAL OVERHEAD CAMSHAFTS
- √ FLYWHEEL END CAM DRIVE
- √ EXTRA HEAVY CRANKSHAFT
- √ SYMMETRICAL DESIGN

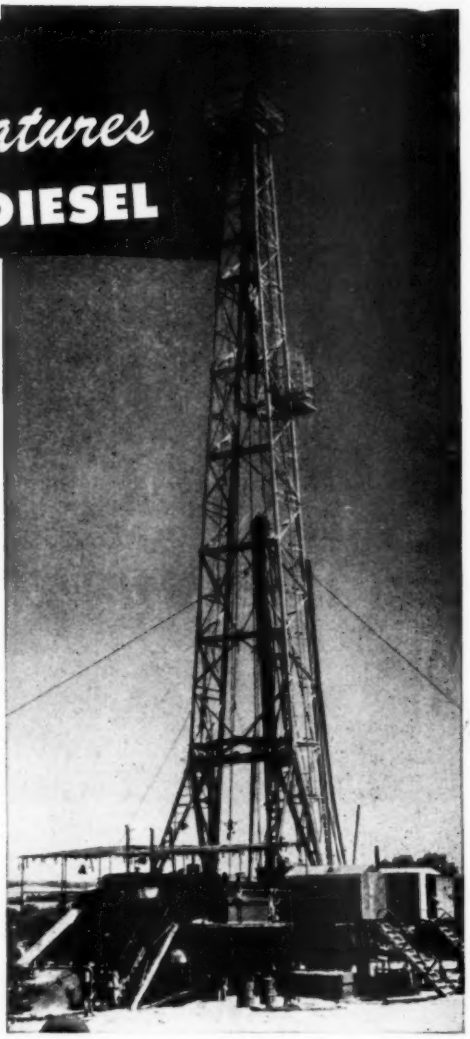
ONLY MURPHY DIESEL HAS THEM ALL and they mean more power . . . greater fuel economy . . . less down time . . . longer engine life. A complete description of all these features and many others—and what they mean to you—is given in the booklet "*10 Questions to Ask a Diesel Engine Salesman*". Ask your Murphy Diesel Dealer for a copy or write direct.

MURPHY DIESEL COMPANY

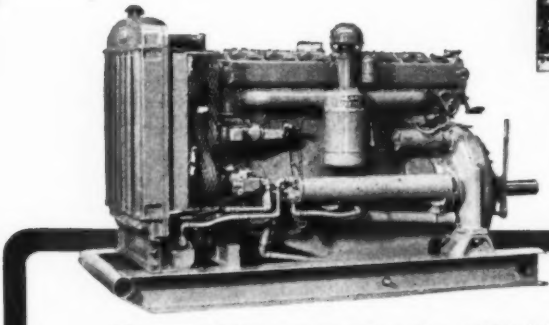
5305 W. Burnham St. Milwaukee 14, Wisconsin

OIL INDUSTRY FACTORY BRANCH Sales, Part Service:
113-117 South Elwood Street, Tulsa, Oklahoma

Sales, Parts and Service: Los Angeles, California; Evansville, Indiana; Great Bend, Kansas; Monroe, Louisiana; Tulsa, Oklahoma; Amarillo, Dallas, Houston, Odessa and San Antonio, Texas; and Edmonton, Alberta, Canada.



Rig of the Aztec Drilling Co., Aztec, New Mexico, which at the time this photo was made, was being used to drill a gas well near Lindreth, N. M. The rig is powered by three 150 H.P. (continuous) Murphy Diesels.



Heavy duty power for the oilfields

Murphy Diesel Engines and Power Units for drilling and pipe line pumping, 90 to 226 H.P., 1200 and 1400 RPM. Generator Sets, 60 to 140 K.W. Dual-Fuel Engines, 135 to 180 H.P. Also Crude Oil Burning Engines.

MURPHY DIESEL

Only with B. F. Goodrich grommet belts can you make these savings!

Save 3 ways! Investigate today! Write or mail coupon

You save belt costs because belts last longer, save production costs because machines keep running with fewer interruptions, save maintenance costs because they need less attention.

Patented grommet belts by B. F. Goodrich represent the only basic change since invention of the V belt. Belts last 20 to 50 per cent longer, depending on service. (The more severe the service, the greater the increase over ordinary belts.) Grommet belts have more rubber; they're more flexible, give better grip, less slip.

What is a grommet?

A grommet is like a giant cable except that it's *endless*—a cord loop built up by winding heavy cord on itself. There is no overlapping cord *section* as in all ordinary belts. Most belt failures occur in these sections where cords overlap!

All cords put to work

Each of the two grommets and every part of a grommet carry their share of the load. In ordinary belts under high tension the center cords "dish" because tension is greater near the driving faces. Dished cords are doing less work, not pulling their share. Grommet belts have no center cords, there is no dishing—therefore much more strength in proportion to cord volume—and less stretch. Grommet belts stretch, on an average, only about one-third as much as ordinary belts.

Better grip, less slip

Grommet belts have more rubber in relation to belt size. Without any stiff overlap, they're more flexible, grip pulleys better. Size for size, grommet belts give ⅓ more gripping power, pull heavier loads with a higher safety factor. Because there is less slip, there is also less surface wear.

Send for proof

Send the coupon for a set of reports telling users' experiences and showing actual installations where grommet belts outlasted all others. Some typical cases:

"... within a few days ordinary belts had stretched ... After six months of 24-hour-a-day service BFG grommet belts haven't stretched at all ..."

"Ordinary belts lasted only 5 or 6 weeks ... B. F. Goodrich grommet belts are in their sixth month of service ..."

"Previous belts suffered from shock loads, wore out fast ... BFG grommet belts have been in service 2 years with no shut-downs..."

There are hundreds of cases like these.

They cost no more

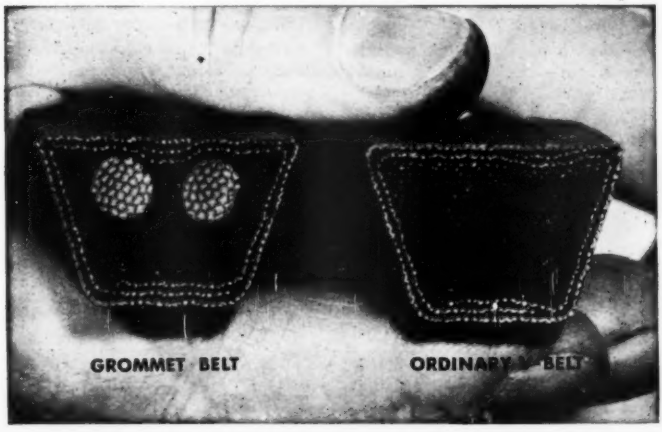
BFG grommet belts cost not one cent more than others. The savings they make for you are clear profit. They are made in C, D and E sections. They are patented by B. F. Goodrich. No other V belt is a grommet belt (U. S. Patent No. 2,233,294).

Write, send the coupon or see your B. F. Goodrich distributor. (He will show you his "X-ray" belt that shows the grommet construction clearly.)

Grommet Belts BY

B.F.Goodrich

FIRST IN RUBBER



The B. F. Goodrich Company
Dept. OJ-12
Akron, Ohio

☐ Send set of reports telling users' experiences and showing actual installations proving that B. F. Goodrich grommet belts outlast all others.

☐ Have distributor show me the "X-ray" belt that shows how B. F. Goodrich grommet belts are made.

Name_____

Firm Name_____

_____

Street Address_____

City_____

State_____

Everywhere...including WEST TEXAS

"Oilwells" No. 76 Rigs

are doing an OUTSTANDING job

In Oklahoma . . . on drilling barges in the Gulf . . . in the Rocky Mountains . . . in Canada . . . and in West Texas . . . the No. 76 Rig which "Oilwell" designed for drilling depths between 6,000 and 10,000 feet, is turning in some great performance records.

For example—note the No. 76 Rig which Bosworth Drilling Company is using with an "Oilwell" Portable Derrick. This completely-equipped "Oilwell" rig went into service April 3, 1951 on the Munger Nix #1 in central Andrews County of West Texas and by Oct. 10, was drilling its sixth well below 7000 feet with negligible downtime for maintenance adjustments.

"Oilwell" No. 76 Draw Works and No. 700 Drives are designed with compact, unitized assemblies, simplified controls (many of which are air operated) and drilling capacities far beyond that of other models of comparable size and weight. A two or three-engine drive with one or two pump take-offs can be furnished—enabling you to utilize input horsepower with maximum efficiency and economy for each type of drilling within its capacity range.

If you are interested in outstanding equipment for medium depth drilling . . . ask your "Oilwell" Representative for Booklet No. 2-51 on "Oilwell" No. 76 Mechanical Rigs.

OIL WELL SUPPLY COMPANY

Branches Serving All Oil Fields

Executive Office—DALLAS, TEXAS
Export Division Office—
30 ROCKEFELLER PLAZA
NEW YORK 20, N.Y.

Division Offices — CALGARY, CANADA
CASPER, WYOMING . . . COLUMBUS, O.
DALLAS, TEXAS . . . HOUSTON, TEXAS
TULSA, OKLA. . . . LOS ANGELES, CALIF.

USS TRADE MARK

"OILWELL" TRADE MARK

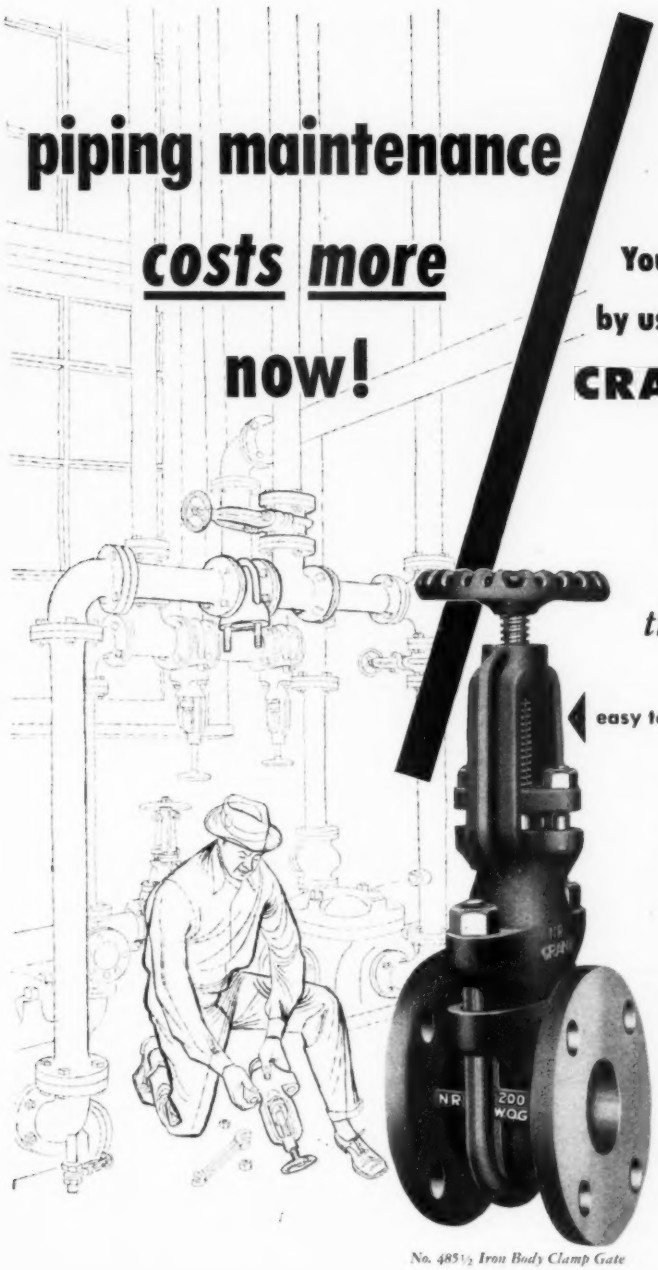
UNITED STATES STEEL

piping maintenance *costs more* now!

You spend less on it by using Dependable Quality

CRANE VALVES

. . . That's why more Crane Valves are used than any other make



No. 485½ Iron Body Clamp Gate

easy to open for inspection

It's no trick to dismantle this clamp gate valve for inspection, cleaning, or servicing. Just remove two nuts and lift out the complete bonnet and disc assembly. The body stays in the line. Reassembling is just as easy. Repeated opening does not affect bonnet joint tightness or alignment.

A real time and labor saver on lines needing periodic cleanout, Crane Outside Screw and Yoke Clamp Gates are made in materials suited to a variety of services. Also Inside Screw with rising stem and Quick-Opening Patterns. Choice of flanged or screwed ends.

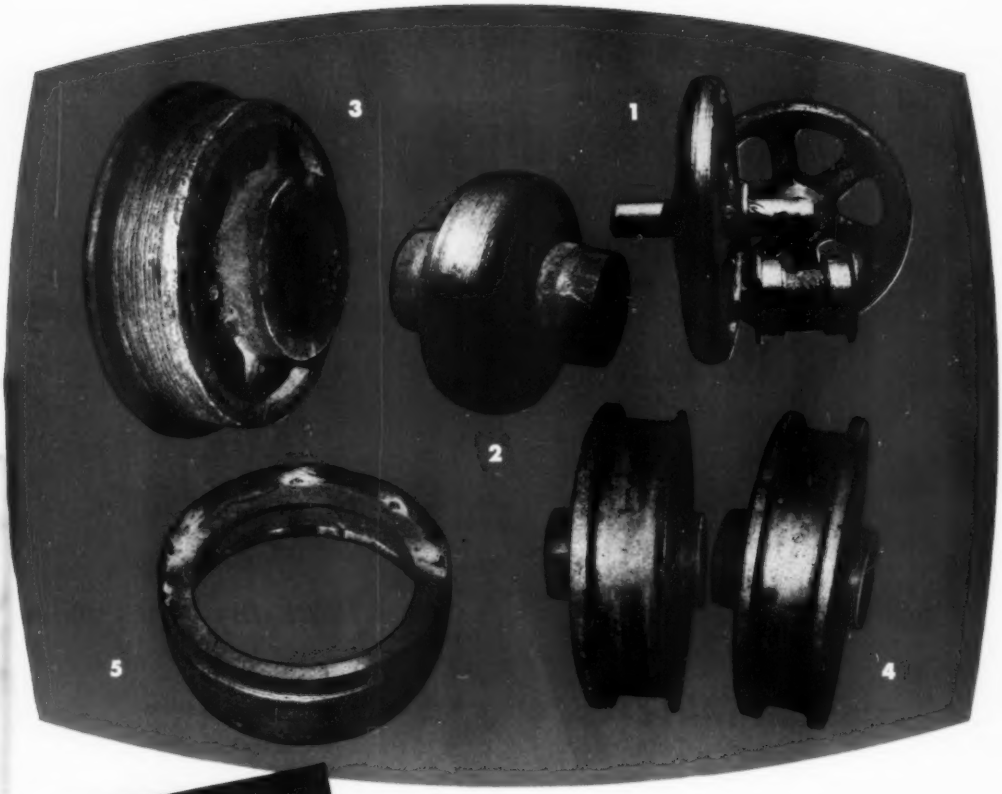
For complete valve suitability at lower ultimate cost, you're better off with Crane Valves. Ask your Crane Representative for demonstration.

CRANE CO.

General Offices:
836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

The Oil and Gas Journal, published Thursdays by The Petroleum Publishing Company. Entered as second-class matter September 1, 1910, at post office at Tulsa, Okla., under act of March 3, 1879. U. S. and foreign rates to the petroleum industry, $3 yearly. Copyright 1951.



1. SHOVEL IDLERS
Built up and hard-faced automatically with Stoody 105, this shovel idler and tractor roller are exceptionally smooth and long wearing.

2. SHOVEL ROLLS
Note the even deposit on this shovel roll. Stoody 105 will at least double its useful life—save hours of downtime.

3. MINE CAR WHEELS
Mine car wheels sustain heavy wear from track debris. Stoody 105 retains size and roundness—keeps wheels on the job under difficult conditions.

4. CRANE WHEELS
Here, unprotected and hard-faced crane wheels are compared. Note wear evident on flange of unprotected wheel, left. Stoody 105 has held size on wheel at right.

5. BRAKE DRUMS
Surface of this brake drum is automatically hard-faced with Stoody 105 and subsequently machined. Resulting smooth surface far outwears unprotected drum.

STOODY 105 keeps the wheels of industry turning . . .

with less wear—less down time—less cost

Everywhere you look—in almost any industry, you see wheels in use. Some work *in* earth, others operate metal against metal . . . *but almost all are subject to heavy abrasion, loss of size, loss of life!* The quick, sure way to reduce wear . . . to keep these wheels of industry rolling . . . to cut maintenance is to hard-face with STOODY 105! It's a time-tried, proven procedure that saves equipment and dollars and reduces the need for hard-to-get replacements.

See your Stoody Dealer—600 in U. S. and Canada—for friendly help, or write direct.

STOODY COMPANY

11938 E. SLAUSON AVENUE, WHITTIER, CALIF.

STOODY 105

APPLIED BY THE AUTOMATIC ELECTRIC WELDING METHOD

PICTURE OF A PLANT—

Equipped for ANY Pipe Threading Operation!

An installation of eight LANDIS Pipe Threading Machines is shown at Jarcho Brothers' plant in Long Island City. These machines, ranging from 2" to 12" in size, thread, ream, bevel, and cut off pipe varying from ½" to 12" in diameter.

LANDIS Pipe Machines are built for heavy-duty service in continuous production. Quality threads and close concentricity is guaranteed by the sleight floating action of the die head in the T-slot of the crossrail, and by the adjustable grip feature which assures correct alignment of the work in the chucks.

Tool inventories are relatively small since the LANDIS Chasers used will thread all diameters within the range of the die head having the same form, pitch, and taper. These chasers also reduce tool replacement cost for they can be reground and used for most of their length, and can be replaced individually as needed.

LANDIS

LANDIS *Machine* COMPANY • WAYNESBORO PENNSYLVANIA

THE WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF THREAD GENERATING EQUIPMENT

Represented in the Domestic Oil Fields by: Colcord-Wright Machinery & Supply Co., St. Louis, Mo.; C. J. Harter Machinery, Houston, Texas; Frederic-Baker Co., New Orleans, La.; Moore Machinery Co., Los Angeles and San Francisco, Calif.; Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo.

General Electric Announces

A NEW ADVANCE IN

type DP

Custom Performance from Standard Turbine Drives now possible through new Designs and Manufacturing Methods

Now you can select the mechanical-drive turbine that will give you maximum mechanical power for your fuel dollar . . . and without the delay and expense of special engineering. General Electric's four new multi-stage drives are *standards*, designed to meet your *specific* requirements.

Four new governing systems give you a wide selection of performance ratings. A new sectional valve gives you greater efficiency for part load operation. Many other improvements make these the finest turbines of their size General Electric has ever produced.

Secret of their adaptability is in the method of manufacture. By using interchangeable casting patterns, designed to be combined in a variety of ways, it's possible for the factory to "customize" standard machines for individual applications. You get a better turbine, designed for your job, and the delivery time is shorter, the cost lower.

Get the full particulars on these new multi-stage turbine drives. Write for our new bulletin, GEA-5580, "G-E Multi-Stage Turbine Drives." General Electric Company, Section 252–53, Schenectady, N. Y.

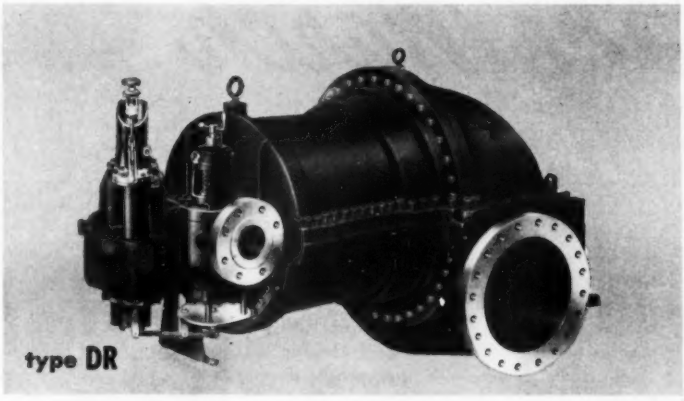
GENERAL ELECTRIC

252-53

MULTI-STAGE TURBINE DRIVES

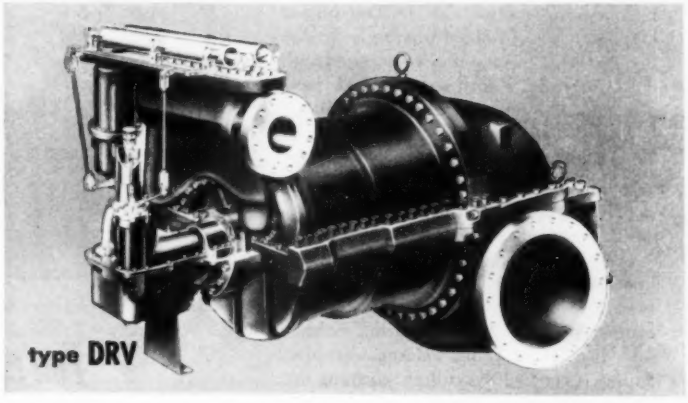
type DP

Dependable power over a 30 per cent adjustable speed range.



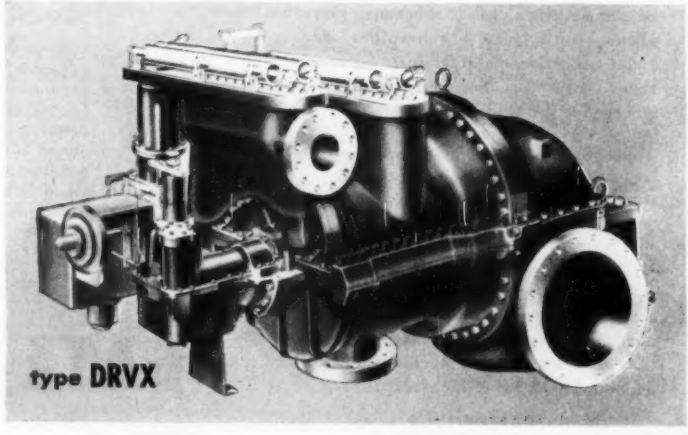
type DR

Oil-relay governor makes possible a speed range of 6 to 1, with only 4 per cent regulation and ½ per cent steady state speed variation.



type DRV

Automatic sectional valves linked to the oil-relay governor minimize throttling losses under fluctuating load factors, make possible substantial operating savings.



type DRVX

For applications where process steam is desired at a definite, steady pressure. Extracted steam pressure remains constant even when load on the unit fluctuates and the flow of extracted steam varies.

Pipeline on the March

. . . And a fast-stepping "march" it is with "Caterpillar" equipment in command. Just the kind of equipment that's needed to speed projects directly or indirectly associated with the national defense! To supply both rearmament and civilian activities with natural gas, the final section of the big "Super Inch" is here seen approaching its terminus near Llanada, California. With military unison, three "Cat" D8 Tractors put long stretches of welded pipe to bed – fast but gently. Of course they're outfitted with the right gear for such work. Offset track, plus added counterweighting, puts mighty lifting-and-lowering capacity into their Trackson Pipe Layers.

Because the work is tough, varied – and ceaseless around the clock – "Caterpillar" equipment has figured in the construction of most of the estimated 17,000 miles of pipeline laid in '51. It is widely preferred because (1) "Cat" machines can handle so many pipeline jobs – in clearing right of way, ditching, stabbing, welding, wrapping, doping, lowering, backfilling, cleaning up; (2) because they STAND UP under all kinds of punishment; and (3) because there is always within reach a "Caterpillar" dealer rich in experience and facilities for keeping them on the job. So, while governmental emergency demands come first –

Take your maintenance problems to your "Caterpillar" dealer* BEFORE *parts are worn beyond repair

He can build up track grousers, rerim sprockets, turn track pins and rollers for new wearing surfaces, refinish cylinder liners and crankshafts, recondition pistons, cylinder heads, radiators – salvage many other parts that will keep your machines operating dependably and lengthen their life.

CATERPILLAR, PEORIA, ILLINOIS

You're the Doctor

Good care is good medicine—for man or machine

CAREFUL LUBRICATION practices, for instance, will add much to your satisfaction through equipment performance, economy and long life. Use only recommended lubricants, changing the lubricant at proper intervals . . . and use *only* "Caterpillar"-proved filter elements. Remove dirt from fittings and clean around crankcase filler cap before adding oil. A little care saves many hours of engine life. *Consult the Lubrication Chart in your Operator's Instruction Book.* AND REREAD THE BOOK OFTEN.

CATERPILLAR

REG. U. S. PAT. OFF.

DIESEL ENGINES • TRACTORS • MOTOR GRADERS • EARTHMOVING EQUIPMENT

TOOLS

ADVANCED...HIGHLY-SPECIALIZED

one of many reasons why

HALLIBURTON'S *best*
for your DRILL STEM TEST!

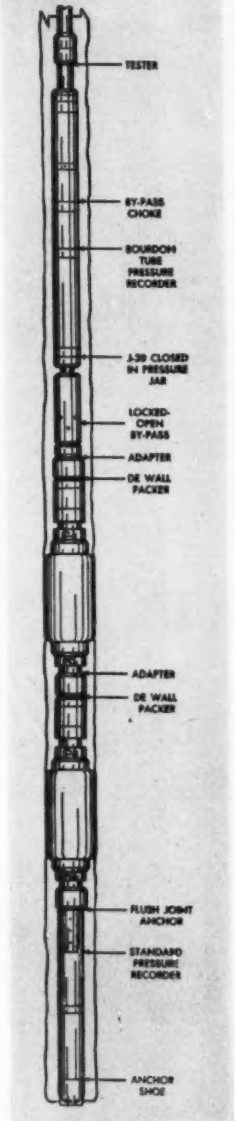
You want your test to be right on the first run—and *Halliburton can do it!*

Misruns are rare with Halliburton because of its advanced, highly-specialized testing tools. The Halliburton string has many exclusive features developed by 25 years grass-roots research and improved by the enormous experience of servicing over a million wells.

For example, Halliburton has a new curved J-slot that automatically locks every tool. It prevents valves from opening too soon and permits the tool to automatically close and positively lock simply by raising the drill pipe a few feet.

Other exclusive features include the Bourdon Tube Pressure Recording Device, special-duty packers to meet various hole conditions, locked open By-Pass, surface controlled adjustable chokes and the multi-purpose circulating valves. These last two features also provide a greater degree of safety and a better control of the well when high pressures are met.

Constant improvement in tools and technology enables Halliburton to maintain its leadership and keep pace with the ever-changing requirements of the oil industry. No matter how deep the well, how high the pressures or temperatures, Halliburton can give you a successful test. Avoid excessive misruns, let Halliburton make your next test! Halliburton Oil Well Cementing Company, Duncan, Oklahoma.



MORE REASONS WHY HALLIBURTON'S best!

GREATER ACCURACY IN PRESSURE RECORDING

The Bourdon Tube Pressure Recording Device, exclusive with Halliburton, gives you far greater accuracy at no extra cost.

25 YEARS RESEARCH BACKS UP YOUR TEST

Halliburton alone offers a testing service developed and improved by 25 years of energetic, grass-roots research.

YOU GET REAL PERSONAL SERVICE

Your Tester stays on the rig from start to finish of your test, giving you his full-time attention during this highly important operation.

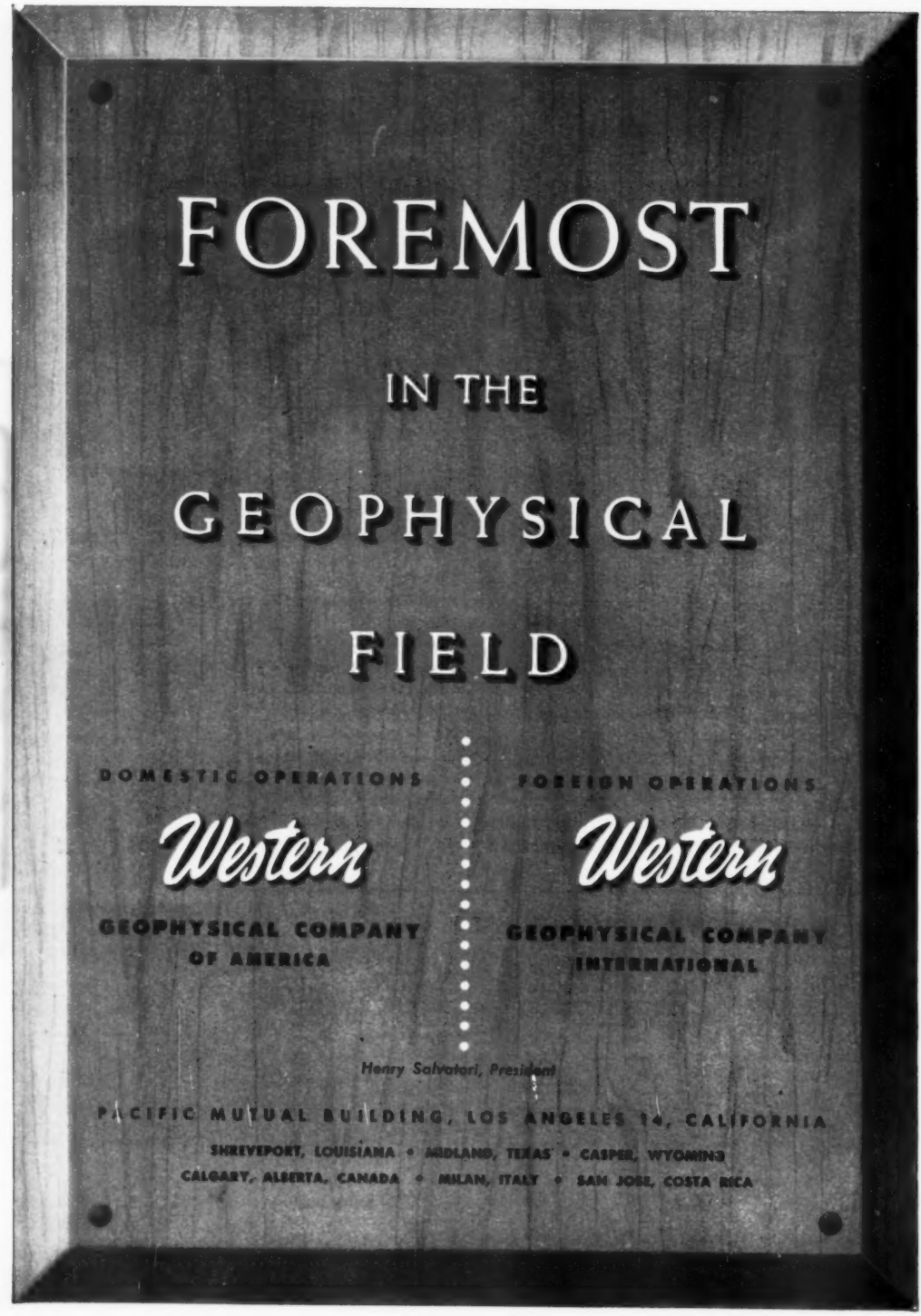
YOU'RE ONLY MINUTES AWAY

Halliburton has hundreds of highly-trained Testing Specialists experienced in every type of well. One of these Testers is only minutes away.

YOU'RE SURE IT'S AVAILABLE

Each Halliburton Tester is completely equipped with the latest tools and ready to go as soon as you call. Phone him before you come out of the hole.

HALLIBURTON *YEARS AHEAD IN DRILL STEM TESTING!*


FOREMOST
IN THE
GEOPHYSICAL
FIELD
DOMESTIC OPERATIONS
Western
GEOPHYSICAL COMPANY
OF AMERICA
FOREIGN OPERATIONS
Western
GEOPHYSICAL COMPANY
INTERNATIONAL
Henry Salvatori, President
PACIFIC MUTUAL BUILDING, LOS ANGELES 14, CALIFORNIA
SHREVEPORT, LOUISIANA • MIDLAND, TEXAS • CASPER, WYOMING
CALGARY, ALBERTA, CANADA • MILAN, ITALY • SAN JOSE, COSTA RICA

NOW You Can *See* Where You Can't *Look*

The DIAMOND "UTILISCOPE"

Wired Television

is now

Saving Labor • Increasing Sales
Preventing Accidents
Improving Product Quality

for others

what can it do for YOU?

The Diamond "Utiliscope" is television which transmits by wire instead of by broadcast. It will provide a faithful and instantaneous reproduction at a distance of any scene, action, demonstration, or operation. It can look into furnaces, observe explosions or other dangerous operations without hazard to the operator.

Corners, walls, and other obstructions are no obstacle to the "Utiliscope." The image is clear and unmistakable, and as 60 individual image fields are transmitted each second (sound movies have only 48) every movement before the camera is transmitted accurately with no measurable time delay.

If you have any operation which needs to be seen close up, but which is too dangerous, inaccessible, costly, or incompetent to be watched in person, you need the "Utiliscope." If it is to your advantage to show a demonstration, display, or other scene to a large number of people at a distance, the "Utiliscope" will do it.

The "Utiliscope" is not costly . . . has exceptional stability and reliability . . . requires no special skill for installation and operation. Write for Bulletin 1025 describing the "Utiliscope" and suggesting some of its many uses.

The "Utiliscope" (Registered U. S. Patent Office)

TYPICAL USES—*Studying destructive tests of engines • Watching flow of molten steel • Checking remote gauge readings • Observing conditions inside furnaces • Viewing nuclear research • Coordinating materials flow on conveyors*

DIAMOND POWER SPECIALTY CORP.
First in Industrial Television
LANCASTER, OHIO
Diamond Specialty Limited • Windsor, Ontario

Since 1903, Diamond has Manufactured Quality Equipment for Industry

4106

Write for Bulletin 1025

THIS AD IS

"FISHING"

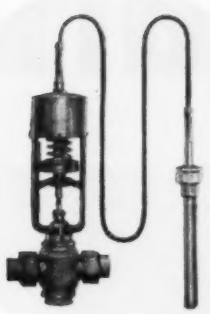
Frankly, we don't know what uses you may find for the "Utiliscope" (Wired Television) . . . so in the adjacent ad we are simply telling you what it will do. Based on our experience in several other industries, we suspect there are many places where the "Utiliscope" will help you improve product quality, save manpower, prevent accidents or increase production.

If you want to look into the possibilities of the "Utiliscope," simply write us for a copy of Bulletin 1025A which explains the equipment and shows various applications. Please address your request to Department "A".

Diamond Power Specialty Corporation
Department "A"
Lancaster, Ohio

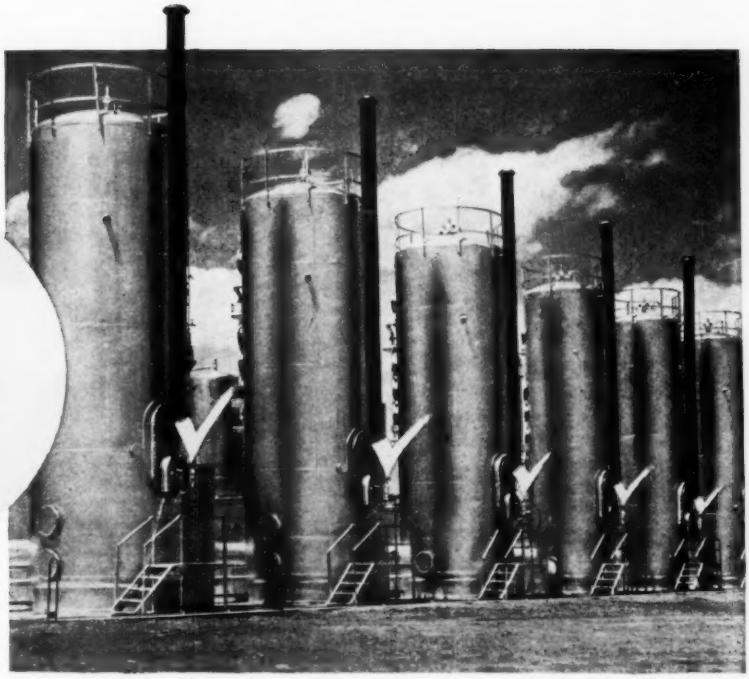
Something you can't see makes a BIG difference!
New SLYDEZE SLIPS practically eliminate slip-to-cone friction in Lane-Wells Packers
SLYDEZE SLIPS are helping to reduce the dangers of stuck packers, because they slide easily under all service conditions. A special coating, permanently bonded to the back of the slips, gives an ever-lubricated surface which practically eliminates slip-to-cone friction.
Since as much as 25% of the force required to "unset" a packer goes directly into overcoming the usual slip-to-cone friction, it's easy to see the value of this new improvement. Easy to see, also, why reports from users in the field are enthusiastic about SLYDEZE SLIPS.
LANE WELLS
Tomorrow's Tools-Today!
Ask Your Lane-Wells Man!
General Offices, Export Office and Plant • 5610 So. Soto St. Los Angeles 58, California
Los Angeles • Houston • Oklahoma City
Lane-Wells Canadian Co. in Canada
Petro-Tech Service Co. in Venezuela

It "takes" a giant's temperature ...controls it automatically



SYLPHON TEMPERATURE REGULATOR No. 923-5

Valve sizes from ¼" to 1½". Reverse acting type available. Can be supplied with fin type bulb for controlling temperature of air or gases.



Sylphon Temperature Regulators used on emulsion treaters. Photo courtesy National Tank Co., Tulsa, Okla.

● There's no job too big for a Sylphon Temperature Regulator. Take the giant-sized emulsion treaters pictured here, for example. A Sylphon Regulator on each one makes sure that the proper temperature for separating the water from the emulsion is maintained correctly. And it does it automatically—day and night. Operations run efficiently—economically.

The Sylphon Regulator used here is No. 923-5. It is simply constructed and self-operated. It has built-in, over-temperature protection; the thermostat assembly is safeguarded against damage in the event the regulator bulb is subjected to above-limit temperatures.

No. 923-5 is sturdily built—serves for years practically maintenance-free. It's original equipment on most leading emulsion heaters and treaters.

Write for information about No. 923-5. Or about the complete line of dependable Sylphon controls for temperature and pressure that serve in practically all industries. Ask for Catalog YO-A.

FS

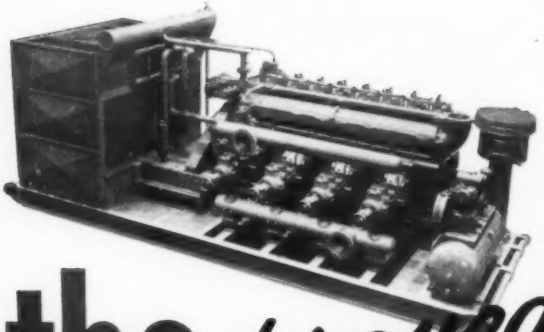
FIRST WITH BELLOWS

Temperature Controls • Bellows Devices • Bellows Assemblies

FULTON SYLPHON
DIVISION

ROBERTSHAW-FULTON CONTROLS CO., KNOXVILLE 4, TENN.

Canadian Representatives, Darling Brothers, Montreal



and now, even the proved Clark

There can be no compromise in selecting a semi-portable heavy duty compressor for oil field work. Either it can take the hard service or it can't. And six years of grueling field service have proved beyond a doubt that the Clark Midget Angle *can* take it. Today it incorporates even greater ruggedness than before to take the toughest kind of service and still come back for more.

Tremendous loads, a minimum of attention — the HMA of today has the stamina to keep driving where a less rugged unit would quit. That's what makes it so ideal for boosting field gas into pipelines, for gas lift operation and hundreds of other applications. *It is still the only compressor of its kind specifically engineered from the ground up for semi-portable service.*

Fully assembled and thoroughly tested at the Clark plant, the HMA comes to you as a completely self-contained, "packaged" compressor station ready to be operating in a matter of hours. And because it has perfect balance both horizontally and vertically, by reason of the *patented* Clark design, you can install it *anywhere* — on piling, swampland, barges, trailors, etc. — with little or no foundation.

With 8¼" bore and 8¼" stroke, the skid-mounted or stationary HMA is available to you in super 2-cycle, standard or high compression models of 2, 4, 6 or 8 cylinders, covering a range of 80 to 330 bhp.

Consult your nearest Clark representative at once, to obtain full details and literature.

there's a BIG difference in . . .

CLARK®

COMPRESSORS

CLARK BROS. CO., INC. *One of the Dresser Industries* **OLEAN, N. Y.**

New York • Tulsa • Houston • Chicago • Boston • Washington • Los Angeles • Birmingham • Detroit • Salt Lake City • San Francisco • Buffalo • London • Paris • Varese, Italy • Ankara, Turkey • Buenos Aires • Caracas, Venezuela • Lima, Peru • Bogota, Colombia • New Delhi, India

greater ruggedness...

Midget Angle

New with the HMA of today

- Exceptional capacity for temporary overloads
- Lowered fuel consumption
- Full precision bearings
- Extra heavy, forged steel crankshaft
- Parco-Lubrized power cylinders and pistons
- Special, heavy duty radiator
- Simplified maintenance

THAT'S GOOD ADVICE

BUT

if you use TANNEX

you won't have to use an ax, or call on the Deity for help. You won't worry about the weather when you use TANNEX, because this improved quebracho compound won't lump, cake, or turn hard. No losses from spoilage when you use TANNEX, no wastage from undissolved lumps settling in the mixing barrel. In any weather, TANNEX is a free-flowing, uniform dry powder which goes into solution and reacts quickly with the caustic. Used exactly as you would use quebracho, TANNEX gives you all of the advantages of quebracho plus no caking, no spoilage, no lost time! You can get TANNEX from any of BAROID'S 500 distributors.

★ Reprinted by permission from World Oil — June, 1951.

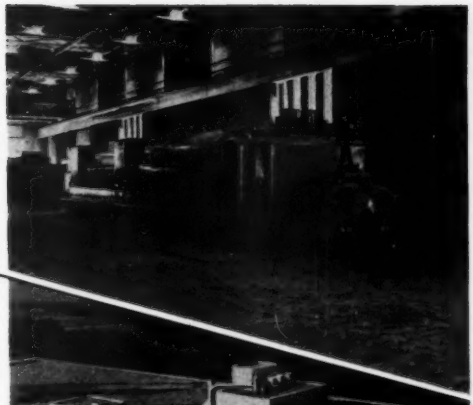
Baroid
BAROID SALES DIVISION
NATIONAL LEAD COMPANY
LOS ANGELES 12 · TULSA 3 · HOUSTON 2

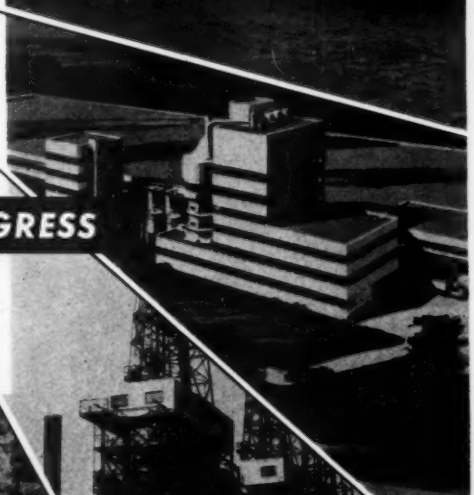
COMPLETE DRILLING MUD SERVICE

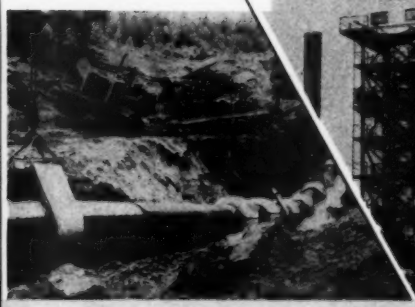
BECHTEL

Engineering · Construction

PACEMAKERS OF PROGRESS







Natural resources harnessed to man's use,

...power, processing and industrial plants producing the essentials of life,

...pipe lines, piers, railroads and highways for the transport of men and goods

are some of the contributions to progress made by Bechtel engineering and construction in the service of industrial clients.

Experience in depth in all of these and related fields is available promptly, wherever needed.

BECHTEL CORPORATION

BUILDERS FOR INDUSTRY

SAN FRANCISCO

Los Angeles · New York

for
AIRCO'S 800
WELDING
TORCH

no job
too
tough

Airco's versatile 800 torch meets the demands of today's speeded-up production and maintenance schedules. Flame-cleaning . . . brazing . . . hard-facing . . . welding the heaviest sections . . . whatever the work in the shop, you can be sure that the "800" will handle it quickly and economically.

For long life, the torch head is made of durable monel. Sturdy brass forgings and seamless brass gas tubes stand up to the roughest handling. All components require little maintenance.

The "800" is unexcelled for brazing, or for straightening and bending operations. A wide range of tips is available. By adding a cutting attachment, the Airco 800 torch can be quickly converted to cut steel from thin sheets up to 6" plate—ideal for the occasional cutting job.

Dependable performance? You're sure of it from the 800 torch, thanks to Airco's 35 years of engineering know-how. Learn about Airco's complete line of arc and oxyacetylene equipment and supplies. Get in touch with your local Airco office today. Representatives will be glad to help you with any welding or cutting problem.

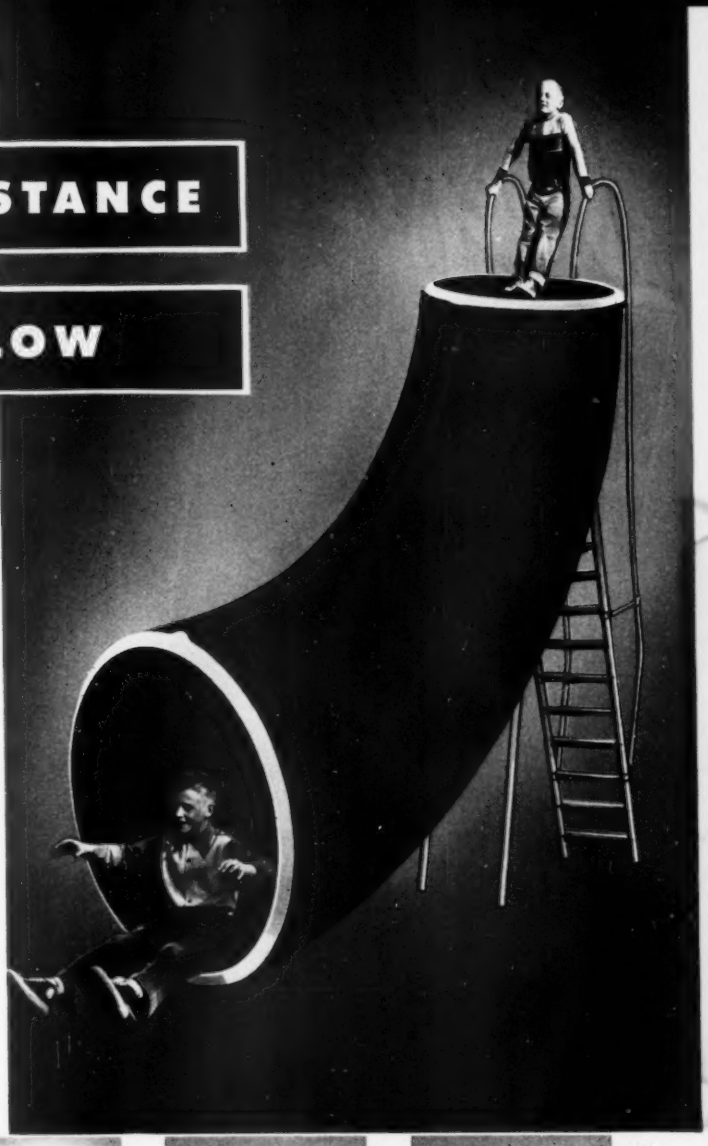
AIRCO **AIR REDUCTION MAGNOLIA COMPANY**

A Division of Air Reduction Company, Incorporated

Beaumont • Corpus Christi • Dallas • El Paso • Fort Worth • Hobbs
Houston • Oklahoma City • San Antonio • Shreveport • Tulsa • Wichita Falls

Southwestern Headquarters for Oxygen, Acetylene and Other Gases . . . Carbide . . . Gas Welding and Cutting Machines, Apparatus and Supplies . . . Arc Welders, Electrodes and Accessories

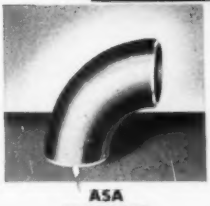
LOW RESISTANCE to FLOW



Minimum resistance to flow . . . that is the feature of Midwest Welding Fittings we call to your attention with this photographic fantasy. Other superior qualities that result from our unique manufacturing methods are dimensional accuracy and uniformity . . . true circular cross-section, controlled wall thickness, and accurate radius, included arc and tangents. The consequent benefits are a saving in welding time and a better piping system.

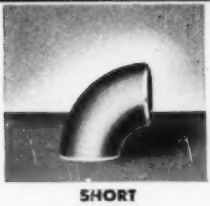
MIDWEST "LONG TANGENT"

Same radius as ASA but tangent equal to 25% of nominal pipe size on each end. Saves pipe, layout and welding time. Costs no more than ASA. Sizes to 24".



ASA STANDARD

Dimensions conform to applicable size range of American Standard for Butt-Welding Fittings, ASA B16.9. Tolerances much less than allowable. Sizes to 26".



SHORT RADIUS

Recommended where space limitations do not permit use of "Long Tangent" or ASA Elbows. Sizes to 30".

MIDWEST REDUCING

Takes the place of a straight size elbow and a reducer. Eliminates one weld, reduces pressure drop, easier to insulate. Sizes to 12", reductions to half size.

4581

MIDWEST

PIPING & SUPPLY CO., Inc.

Main Office: 1430 South Second Street, St. Louis 4, Mo.
Plants: St. Louis, Passaic, Los Angeles and Boston
Sales Offices: New York 7—30 Church St. • Chicago 3—79 West Monroe St.
Los Angeles 33—920 Anderson St. • Houston 2—1213 Capitol Ave.
Tulsa 3—224 Wright Bldg. • Boston 27—426 First St.

STOCKING DISTRIBUTORS IN PRINCIPAL CITIES

Lufkin PERFECTION

. . . . IN CRANK COUNTERBALANCING

"LET THE WEIGHTS DO THE WORK." Illustrated above is a very acceptable method of shifting weights on a Lufkin Pumping Unit. The crank is stopped on an incline, the three bolts are loosened and the lead bolt is used as a brake. This operation is quite safe because the weights are equipped with a steel safety lug to prevent sliding off the crank.

Another acceptable method of counterbalancing a Lufkin Unit is to lug the crank on a slight incline, prying the weight along the machined ways of the crank with the aid of a bar. This method is made easy by the notched bottom of the crank slot, enabling the operator to reach the desired position by an easy sliding motion.

The Lufkin Trout Crank gives perfect counterbalance adjustment from minimum to maximum effect with the greatest of ease. One man can easily do the job. Two methods are illustrated herewith. Any method of moving the weights is safe because the weights are equipped with steel safety lugs to prevent sliding off the crank.

Operators find the Lufkin Trout Crank superior for oil field pumping units because of these outstanding features:

1. **EASE OF ADJUSTMENT**—one man can counterbalance a well.
2. **SAFETY**—a steel safety lug prevents the weights sliding off the crank.
3. **PRECISION** — counterbalance of minimum to maximum effect can be obtained by moving weights in a straight line.
4. **SIMPLICITY**—only three bolts to loosen.

LUFKIN FOUNDRY & MACHINE COMPANY
LUFKIN, TEXAS

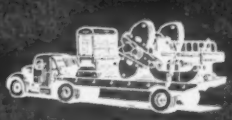
Branch sales and service Houston, Dallas, New York, Tulsa, Los Angeles, Seminole, Oklahoma City, Corpus Christi, Odessa, Artesia, Wichita Falls, Casper, Wyoming, Great Bend, Kansas

Lufkin Equipment in CANADA is handled by...

THE LUFKIN MACHINE CO., LTD., 10321 106th Avenue, Edmonton, Alberta, Canada

LUFKIN PUMPING UNITS

LUFKIN-COOPER-BESSEMER ENGINES



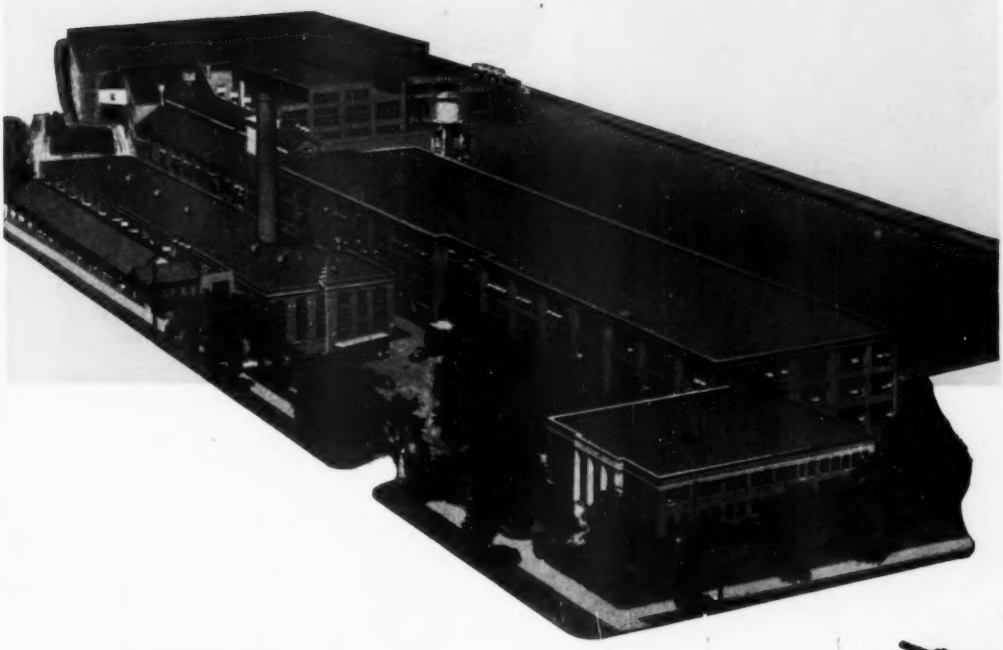
LUFKIN OIL FIELD AND INDUSTRIAL TRUCK TRAILERS

INDUSTRIAL SPEED REDUCERS AND INCREASERS

DIVISION LUFKIN FOUNDRY & MACHINE COMPANY INDUSTRIAL, MILL AND AUTOMOTIVE SUPPLIES

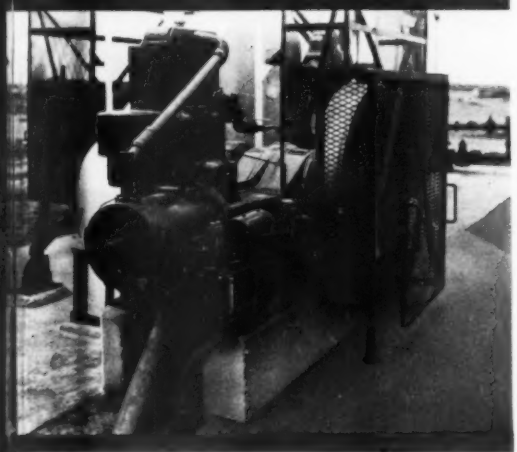
In 1883 we launched from this plant our policy of making the best valves we know how . . . and selling them through the best distributors. We think that explains why today our plant looks as it does below.

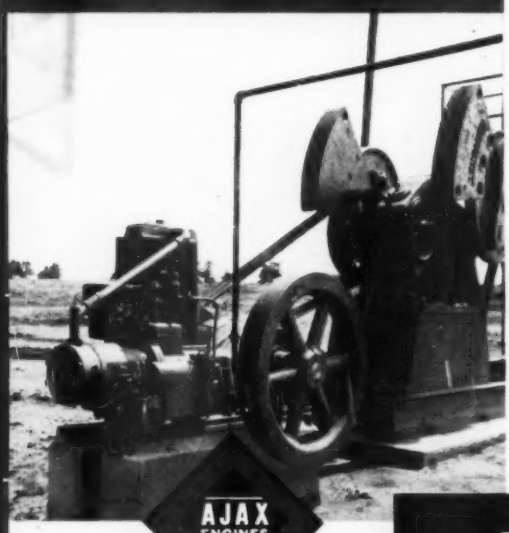
Proof that a policy pays



OIC
FOUNDED 1883

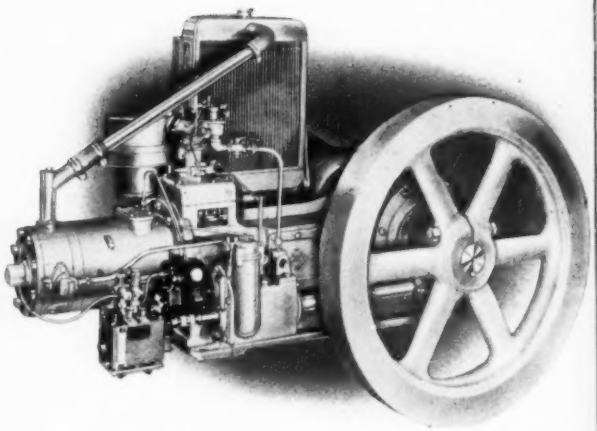
VALVES
FORGED AND CAST STEEL · IRON · BRONZE





CHOSEN BEST

by *Comparative Test!*



Ajax

GAS and OIL ENGINES

Every month, more of the steady stream of AJAX Engines rolling to every field are *ordered on the basis of exacting comparative performance analyses.*

In every instance that has come to our attention, where careful checks have been made on operating economy, maintenance costs, ease of servicing and all-around dependability—*AJAX leads.* Such tests confirm the practical experience of Ajax users everywhere. Talk it over with your Supply Man!

AJAX IRON WORKS
CORRY, PENNSYLVANIA

Oil Field Distributors: THE NATIONAL SUPPLY CO., TOLEDO, OHIO
R. B. MOORE SUPPLY CO., INC., BOLIVAR, N. Y. • BETHLENEM SUPPLY CO., TULSA, OKLA.

Keep Heat Transfer Surfaces CLEAN...

SPECIFY

Vogt

SCRAPED SURFACE *Exchangers*

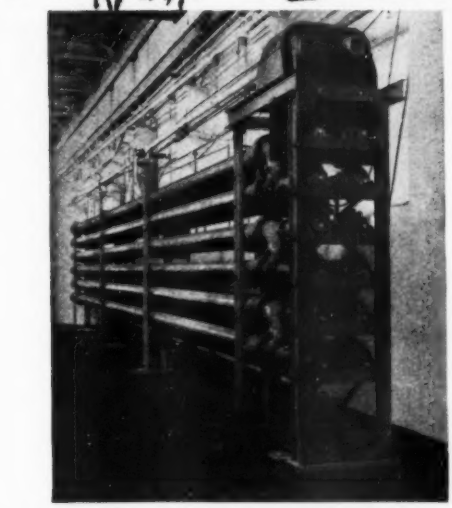
IF you are all "gummed up" with a tough heat transfer problem, Vogt Scraped Surface Exchangers will provide the answer. They have patented scraper elements which prevent fouling of the heat transfer surfaces and insure the highest rate of heat exchange between the product and the cooling or heating medium. The scrapers also continuously agitate the fluid and assist removal of solids from the unit.

DOUBLE PIPE EQUIPMENT is available in two types; EXCHANGERS, for cooling with water, brine, and cold filtrate, and for heating with steam or hot liquids; and CHILLERS, for use with volatile refrigerants such as ammonia, propane, and Freon. Both types have 8" jacket pipes and 6" inner pipes with scrapers.

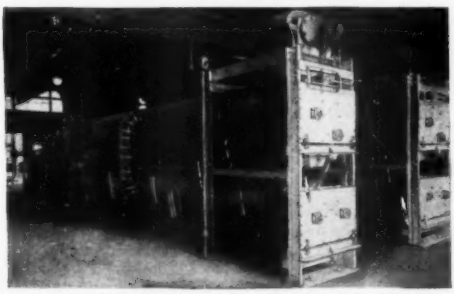
SHELL AND PIPE TYPE UNITS are designed for use with volatile refrigerants and for heating fluids with steam or similar heating mediums. They consist of large welded shells each containing seven 6" scraped pipe sections.

Vogt Scraped Surface Exchangers serve profitably as oil chillers, crystallizers, and heaters in many processes in the petroleum and chemical industries. Their application to your heat transfer problems will receive the prompt attention of our Engineering staff.

Write for Bulletin PE-1



*DOUBLE PIPE UNIT. Drive end close-up of 12 section unit under test in our shop.



*SHELL and PIPE UNITS. Two of five units installed in a leading petroleum refinery.

*Patented

HENRY VOGT MACHINE CO.
LOUISVILLE 10, KENTUCKY

Branch Offices:

NEW YORK • PHILADELPHIA • CLEVELAND • CHICAGO
ST. LOUIS • DALLAS • CHARLESTON, W. VA.

Kidde Dry Chemical Extinguishers shield the operator from the flames with a heat-absorbent curtain of fine powder. The Kidde 20 pounder covers 36 square feet—44% MORE AREA than required by Factory Mutual Laboratories. The Kidde 30 pounder covers 48 square feet—as compared to the 35 square feet required by Factory Mutuals.

These Kidde extinguishers drive the dry chemical with enough force to overcome updrafts caused by the heat of the fire. The special Diffuser Horn applies the powder in a cloud-like pattern—helping to eliminate the splash of flammable liquids and offering the greatest protection to the operator.

For fires in textiles, flammable liquids and live electrical equipment Kidde Dry Chemical Extinguishers are highly effective. Write for information on portable or wheeled units.

Kidde

The word "Kidde" and the Kidde seal are trademarks of Walter Kidde & Company, Inc.

Walter Kidde & Company, Inc., 1255 Main Street, Belleville 9, N. J.

Walter Kidde & Company of Canada, Ltd., Montreal, P. Q.

LUNKENHEIMER *Bronze Globe Valves Give You . . .*

- **The AMAZING Durability of Stemalloy***
- **Plus THREE-WAY Renewable Trim**

Cut your maintenance expense with Lunkenheimer "Renewo" Bronze Globe Valves — featuring the revolutionary new Stemalloy* stems and three-way interchangeability of parts. You can operate with fewer parts in stock, simplify your ordering and handling, make repairs easier. Identical bodies and bonnets for each "Renewo" threesome permit you to convert regular Nickel Alloy "Renewo" valves to either "NS5" Nickel Alloy or Stainless Steel Plug Type simply by changing seats and discs.

Both seat and disc are precision-machined simultaneously — lapped to a *perfect*, mirror-finish fit. You get positive protection against leakage . . . and an extra wide seating surface to retard wire-drawing and promote longer life.

"Renewo" Bronze Globe valve stems are made of Stemalloy*, Lunkenheimer's patented silicon-bronze alloy that eliminates stem-thread failures. Stemalloy* stems have actually been tested at more than 300,000 openings and closings. Millions are in use — without a single failure.

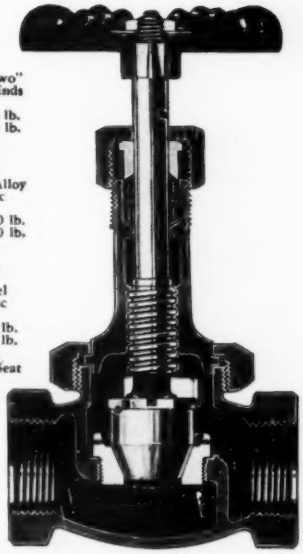
▶ Write for the complete details in Circular 577. It's available from your leading industrial distributor, or from The Lunkenheimer Co., Box 360-F, Cincinnati 14, Ohio.

Bronze—"Renewo" Globe—Screw Ends

Fig. 73-P—200 lb.
Fig. 16-P—300 lb.
Plug Type Renewable 500 Brinell "NS5" Nickel Alloy Seat and Disc

Fig. 73-PS—200 lb.
Fig. 16-PS—300 lb.
Plug Type Renewable 500 Brinell Stainless Steel Seat and Disc

Fig. 73—200 lb.
Fig. 16—300 lb.
Renewable Nickel Alloy Seat and Disc



BRONZE • IRON • STEEL

LUNKENHEIMER

THE ONE *Great* NAME IN VALVES

*Patented Alloy.

BARRETT* COAL-TAR ENAMELS PROTECT AMERICA'S GREATEST PIPELINES

HERE ARE 10 REASONS *WHY...*

1 Products and procedures available for every oil and gas pipeline requirement.
2 Withstand extremely high and low temperatures.
3 High ductility and flexibility.
4 Coatings not damaged by "breathing," nor by back-fill stresses.
5 High dielectric properties.
6 Impermeable to moisture.
7 Resistant to attack by gas and petroleum products.
8 Used by thousands of engineers and contractors.
9 Universally available and easy to apply —applicators all over the country.
10 Barrett engineering service always available.

Barrett*

THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

* Reg. U. S. Pat. Off.

BARRETT Coal-Tar Enamels Protect
The Oklahoma Natural Gas Company Line

JOY

200-Series Motorized Drill Rigs

Built and Field-Proved in 3 models to do your job best!

This family of fast, highly mobile oil field drills—the JOY 225, 250 and 275 Motorized Drill Rigs—are built for deep structure-testing and water-well work, or shallow slim hole production, down to 3000 feet. They are truck or trailer-mounted units with interchangeable parts, reversible rotary mechanism, single or compound engine drive, hydraulic or ordinary feed. An exclusive feature of the 225 and 250 Drill Rigs is the JOY Automatic Hydraulic Chuck, a proved labor saver — reduces costs, increases speed, actually can mean as much as 200′ more hole per day. ● *Ask for complete details.*

Write for Bulletins, or *Consult a Joy Engineer*

W&D O 3001

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

FOR 90° THREADED CONNECTIONS IN ALL HIGH AND LOW PRESSURE PIPING SYSTEMS . . .

specify and use

BONNEY THREDOLETS

YOU DERIVE THE FOLLOWING ADVANTAGES:

1. ACCELERATED FABRICATION—
with ThredOlets no coupling preparation is necessary—you obtain the most economical type of construction.

2. NEAT AND UNIFORM APPEARANCE—
ThredOlets minimize variations caused by human element—you attain the best engineered type of construction.

3. IMPROVED FLOW—
ThredOlets provide a funnelled inlet—you achieve better performance and better piping system design.

4. DIMENSIONAL STANDARDIZATION—
with each ThredOlet installation, you have constant control of the critical center-of-run-pipe to face-of-outlet dimension.

The Bonney WeldOlet Welding Fittings Catalog, No. W-3, provides complete engineering and dimensional data.
Write for your free copy.

WELDING FITTINGS DIVISION

BONNEY FORGE & TOOL WORKS

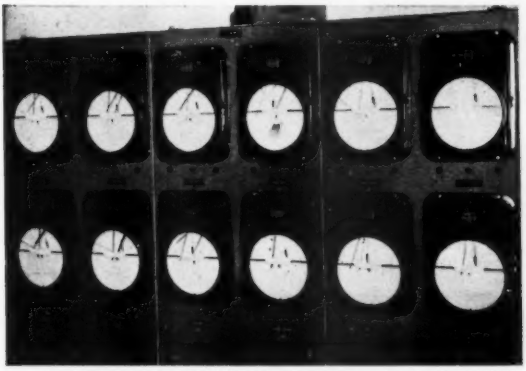
366 Green Street • Allentown, Pennsylvania

Canadian Representative
Sterling Steel Company, Ltd.
267 Davenport Road • Toronto 1, Canada

Export Distributor
National Supply Export Corp.
600 Fifth Avenue • New York 20, New York

GAS DISPATCHING MADE EASIER

by Bristol Metameter* telemeters and remote control



THESE BRISTOL METAMETER RECEIVERS are in the dispatcher's office of Colorado Interstate Gas Company.

AREA COVERED BY BRISTOL METAMETER TELEMETERS. This installation has been in operation for four years.

No matter how far-flung and complex a pipe line system may be, critical pressures and flows all along the line can be observed and controlled from a central point by Bristol Metameters.

The use of Metameters by the Colorado Interstate Gas Company is typical. Bristol Metameter receivers in its Colorado Springs dispatching office record suction and discharge pressures at nine of the compressor stations along its 555 mile gas pipe line and the flow and static pressure at five of its metering stations.

These Metameter telemeters give the dispatcher a clear picture of pressure and flow conditions along the entire pipe line.

Many other pipe line and gas companies from coast to coast use Bristol Metameter to obtain up-to-the-minute knowledge of what is going on throughout their systems and maintain finger-tip control over any combination of conditions that may arise. Several installations have been in operation over 15 years.

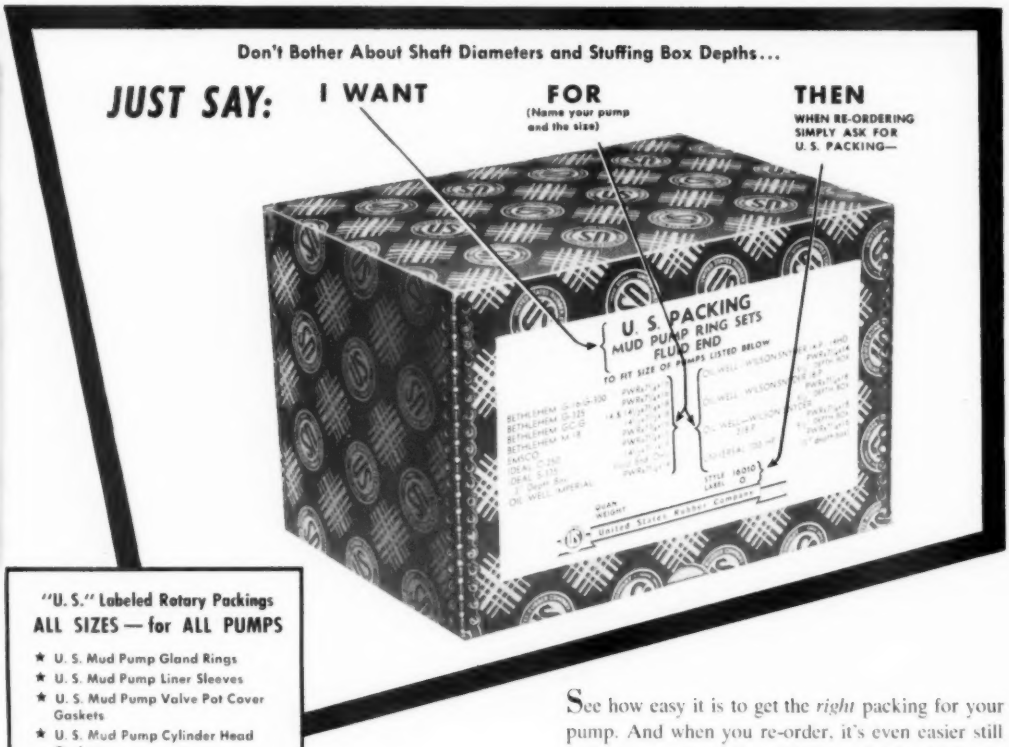
Use by pipe line companies includes (in addition to those mentioned above) remote setting of regulators and flow controllers; remote readings of pressure at transfer point and flow of gas into distribution system; sounding alarms when low and high limits of pressure and flow are exceeded; totalizing flow through several lines. Readings are transmitted over any two-wire circuit or its equivalent (private wires, telephone circuits, carrier channels and radio, including microwave). Receivers may be recording (narrow or wide strip or round chart) or indicating.

For further information on the use of Metameters by pipe line and gas companies, from coast to coast, request Bulletin M1700, THE BRISTOL COMPANY, 120 Bristol Road, Waterbury 20, Conn. *Reg. U. S. Pat. Off.

BRISTOL

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

What's U. S. Rubber doing to make it easy to order rotary drilling packings?



"U. S." Labeled Rotary Packings
ALL SIZES — for ALL PUMPS

- ★ U. S. Mud Pump Gland Rings
- ★ U. S. Mud Pump Liner Sleeves
- ★ U. S. Mud Pump Valve Pot Cover Gaskets
- ★ U. S. Mud Pump Cylinder Head Gaskets
- ★ U. S. Wash Pipe Swivel Packings

PRODUCTS OF U.S.RUBBER SERVING THROUGH SCIENCE

See how easy it is to get the *right* packing for your pump. And when you re-order, it's even easier still —simply use the style number and label letter on the box. This is one of the many, many improvements "U.S." is constantly making—all to save oil drillers time and money. Whatever your packing needs may be, ask for "U. S." and you'll have a product that's completely *right* for the job.

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

SERVICE LEDGER
1901-1951

ANGLO-IRANIAN OIL CO. LTD.
ARGENTINE GOVERNMENT OIL FIELDS
ARGENTINE MINISTRY OF WAR
ATLANTIC REFINING CO.
ATOMIC ENERGY COMMISSION
BRITISH AMERICAN OIL CO. LTD.
CANADIAN OIL REFINERIES, LTD.
CALIFORNIA REFINING CO.
CHAMPLIN REFINING CO.
CIE. DE RAFFINAGE SHELL-BERRE
CIE. FRANCAISE DE RAFFINAGE
CIE. INDUSTRIELLE DES PETROLES
CITIES SERVICE OIL CO.
CITIES SERVICE REFINING CORP.
COLGATE-PALMOLIVE-PEET
CONSOLIDATED REFINERIES, LTD.
CONTINENTAL OIL CO.
CORY BROTHERS & CO., LTD.
CREOLE PETROLEUM CORP.
DIAKEL CORPORATION
EL DORADO REFINING CO.
ESSO STANDARD OIL CO.
GENERAL PETROLEUM CORP. OF CALIFORNIA
GLOBE OIL & REFINING CO.
GULF OIL CORP.
HUMBLE OIL & REFINING CO.
IMPERIAL CHEMICAL INDUSTRIES
IMPERIAL OIL LTD.
KANOTEX REFINING CO.
KENDALL REFINING CO.
LEVER BROS.
LION OIL CO.
MAGNOLIA PETROLEUM CO.
MARINE OIL REFINERS OF AFRICA, LTD.
MATHIESON CHEMICAL CORP.
McCOLL-FRONTENAC OIL CO., LTD.
MID-CONTINENT PETROLEUM CORP.
MITSUBISHI OIL CO., LTD.
NATIONAL PETROLEUM COUNCIL OF BRAZIL
PAN AMERICAN REFINING CORP.
PENNZOIL CO.
PHILLIPS PETROLEUM CO.
POLYMER CORP., LTD.
PURE OIL CO.
SHELL CHEMICAL CORP.
SHELL OIL CO.
SHERWIN-WILLIAMS CO.
SINCLAIR REFINING CO.
SKELLY OIL CO.
SOCIETE DES RAFFINERIES DE PETROLE DE LA GIRONDE
SOCIETE GENERALE DES HUILES DE PETROLE
SOCIETE INDUSTRIELLE BELGE DES PETROLES
SOCONY-VACUUM FRANCAISE
SOCONY-VACUUM OIL CO.
E. R. SQUIBB & SONS
STANDARD OIL CO. (INDIANA)
STANDARD OIL CO. (OHIO)
STANDARD OIL CO. OF CALIFORNIA
SWIFT AND CO.
TEXAS CO.
UNION OIL CO. OF CALIFORNIA
UTAH OIL REFINING CO.
WASATCH OIL CO.
WOOD RIVER OIL & REFINING CO.

From Kerosine to Petro-Chemicals ...on the European Continent!

Kellogg engineers have been working with international refiners since the days when kerosine accounted for a third of the liquid product sales . . . and pot stills were standard equipment. Subsequently, much of Europe's thermal cracking and other refining facilities were supplied by Kellogg.

Through the years, Kellogg has built complete refineries and refining units for the Continental affiliates of such international companies as Esso, Shell and Anglo-Iranian, as well as for the major national refiners of Belgium, France and Italy.

Currently, several major Kellogg designed plants are under construction . . . at Antwerp, Belgium; at Dunkirk and Gonfreville, France; at Ferrara, Italy. These projects encompass one complete refinery and many individual process units. Refining processes being utilized include atmospheric distillation, visbreaking, thermal cracking and reforming, propane deasphalting, Furfural treating, and Fluid catalytic cracking for the British Isles. Allied, though not an actual refining project, is Italy's first plant to produce olefins and their petro chemical derivatives. This latter is Europe's second such plant, the first one having been designed by Kellogg for Imperial Chemical Industries in England.

THE M. W. KELLOGG COMPANY

A SUBSIDIARY OF PULLMAN INCORPORATED

for fifty years an integral part of processing history

NEW YORK JERSEY CITY LOS ANGELES TULSA HOUSTON TORONTO LONDON PARIS

Portrait at

This year is Kellogg's fiftieth of service to industry. At this time naturally, as a group of men—known collectively to the modern business world as The M. W. Kellogg Company—we can think back nostalgically. We can remember the chimney stacks

"In the Final Analysis..."

In previous issues of this magazine, "camera portraits" of M. W. Kellogg today have highlighted major aspects of Kellogg's operations, from basic research through the many steps to job-site construction.

This month, the camera takes a parting look at the construction lot and then focusses, through other company activities, on the over-all picture of Kellogg's service to industry.

1. *KELLOGG'S CONSTRUCTION FORCE* is permanently staffed, right down to key craft foremen. This proves particularly advantageous in the specialized installation of high-pressure, high-temperature utility power piping. Accurate pre- and post-heat as well as welding procedures must be followed to insure perfect fabrication of the alloys now being used for this type of service.

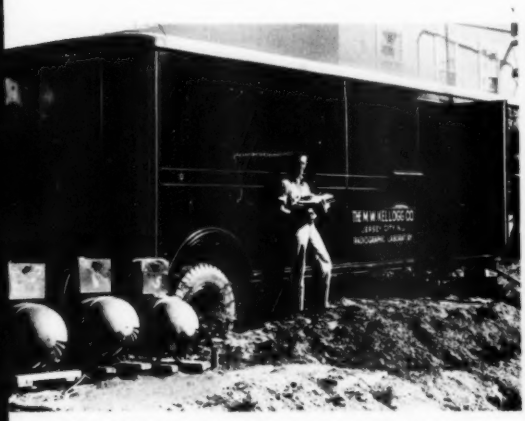
4. THE "PAY OFF" in Kellogg's business is revealed by two ostensibly unrelated activities—accounting and initial operation of equipment or plants. Both contribute to the final evaluation of a job: *How well did it work out cost wise? How well does it perform the job for which it was designed?* From this office Accounting Control is exercised over all Kellogg projects. Spotlighting true costs of even minor activities, this department illuminates the path to lower costs and keeps field supervisors continually cost conscious.

5. *"OPERATING INSTRUCTIONS"* are delivered to customers with completed Kellogg process units. The *practical* operating men who "build" these books start on the task with the inception of each project in the Design Engineering Department. In this way, they make certain that all features required by the customer for efficient operation are incorporated in the final design.

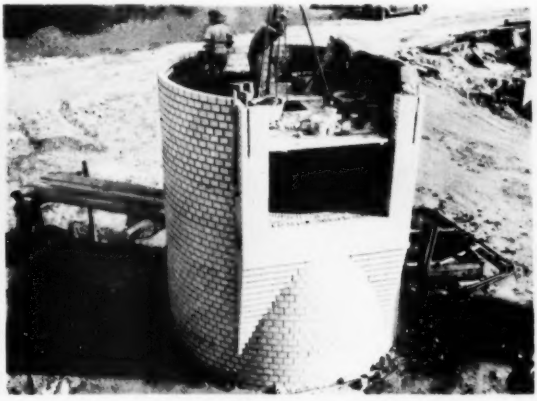
Fifty... not

KELLOGG
1901 1951
50th Anniversary

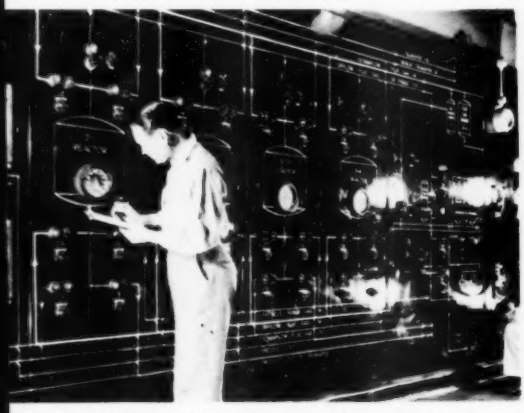
we built in 1901 . . . the first crude vessels for oil refiners in the 'teens . . . our first combination unit . . . the forty-odd Fluid cat crackers built in these years. But, after all, The M. W. Kellogg Company is only a factor as it is able to serve industry today. For that reason, we are presenting this series of monthly camera studies which document our belief that a truly integrated organization can better serve industry to achieve greater earning power. This is No.11 in the series.



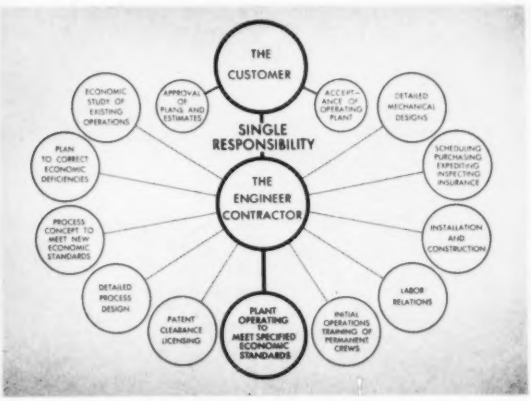
2. *BOTH THE GAMMA AND X RAY* testing equipment, usually associated only with the highest quality shop fabrication, are taken *out into the field* by Kellogg. Originally, much of the equipment was not only specially designed, but in some cases built by Kellogg people. Pictured is one of the company's complete test laboratories-on-wheels.



3. *COMPLEMENTING THE CONSTRUCTION DEPARTMENT* is a division that concentrates on the erection, maintenance and repair of radial brick, common brick and concrete industrial chimneys. This activity has been a Kellogg specialty for nearly fifty years, and a complete staff of chimney engineers provides both new chimney design and an inspection service.



6. *SUBSEQUENTLY, THESE MEN* go into the field and personally check to see that each part of a new unit is completely operable in accord with design specifications. Then, they stand by in an advisory capacity to the customer's regular operating crews throughout the period of initial operation.

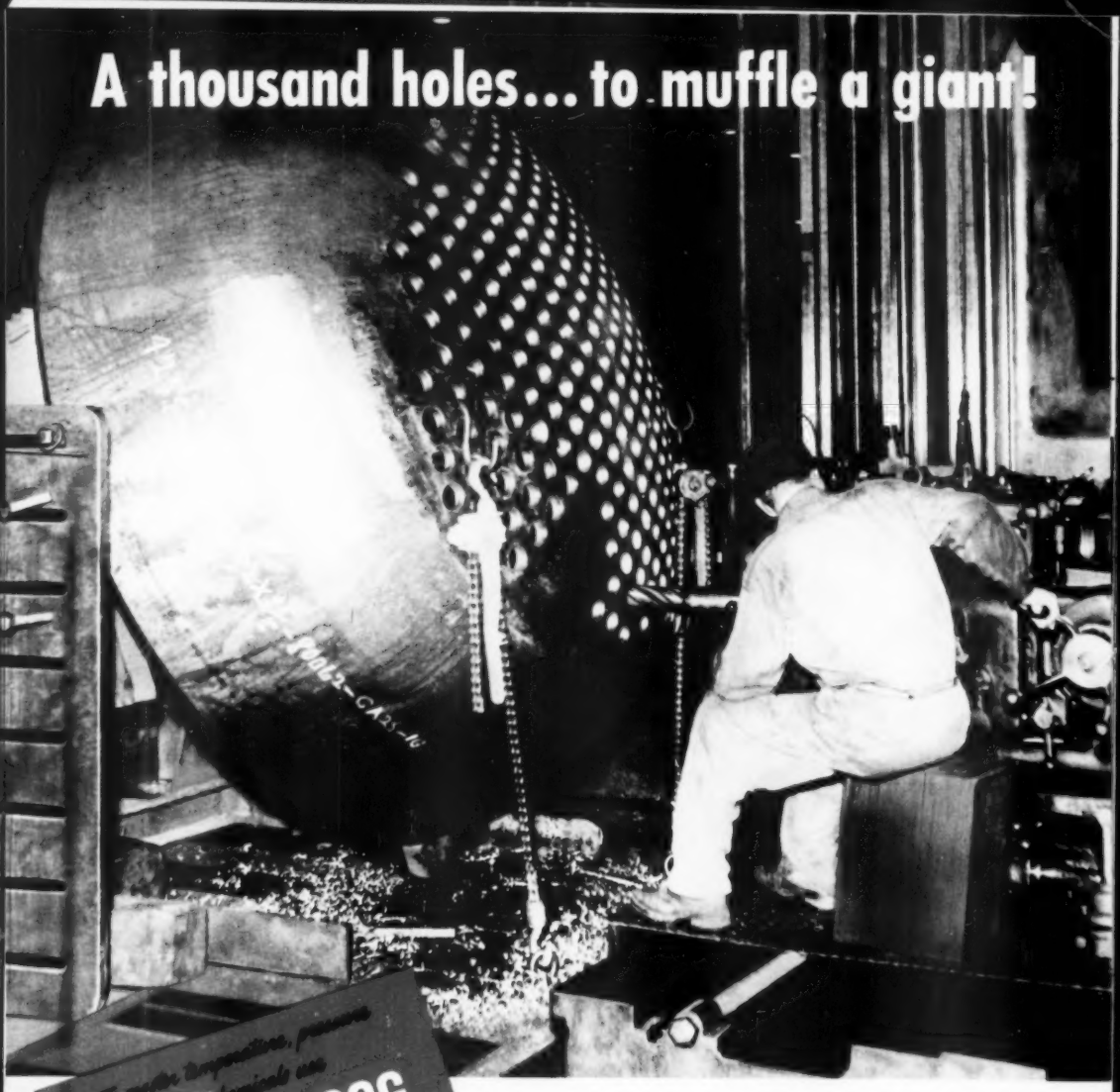

THE CUSTOMER
SINGLE RESPONSIBILITY
THE ENGINEER CONTRACTOR
ECONOMIC STUDY OF EXISTING OPERATIONS
APPROVAL OF PLANS AND ESTIMATES
ACCEPTANCE OF OPERATING PLANT
DETAILED MECHANICAL DESIGNS
PLAN TO CORRECT ECONOMIC DEFICIENCIES
SCHEDULING PURCHASING EXPEDITING INSPECTING INSURANCE
PROCESS CONCEPT TO MEET NEW ECONOMIC STANDARDS
INSTALLATION AND CONSTRUCTION
DETAILED PROCESS DESIGN
LABOR RELATIONS
PATENT CLEARANCE LICENSING
PLANT OPERATING TO MEET SPECIFIED ECONOMIC STANDARDS
INITIAL OPERATIONS TRAINING OF PERMANENT CREWS

7. *THUS IS KELLOGG COMPLETELY INTEGRATED* to serve its customers from initial plan to operating unit . . . integrated to provide every factor, that can contribute *Greater Earning Power* and *Greater Value* to every customer's project.

P. S.

. . . this is the final camera study in the series presented during Kellogg's Fiftieth Anniversary year!

A thousand holes... to muffle a giant!



To master temperatures, pressures and chemicals use

M. W. KELLOGG

process equipment

Part of a huge muffler for a giant catalytic cracker, this perforated, dished, stack baffle is symbolic of Kellogg's especial forte in the field of heavy metal fabricating. It's a first of its kind . . . it requires unusual fabricating techniques . . . it's built to close tolerances!

Pressure Vessels
Vacuum Vessels
Fractionating Columns
Drums and Shells
Heat Exchangers
Process Piping
Hi-pressure—Hi-temp Power Piping
Bends and Headers
Giant One-Piece Bends
Forged and Welded Fittings
Radial Brick Chimneys

Continuing Study of behavior of metals under stress at high temperatures has produced valuable design data.

Shop Layout Craftsmen are fully experienced in vessel fabrication from nozzle positioning to "knockdown" fabrication for field assembly.

Extensive Facilities from forming of plate to final machining of precision surfaces permit complete fabrication under the same roof.

Special Welding Techniques and stress relieving methods assure equipment performance even under severest operating conditions.

Rigid Quality Control, devised by specialists, including chemical and micro analyses as well as mechanical and non-destructive testing.

NEWS FOR OPERATORS IN WESTERN CANADA

The Canadian Kellogg Company Ltd. has established complete shop facilities for the fabrication of all types of piping at **EDMONTON**, Alberta. Inquire directly or through any Kellogg or Canadian Kellogg office.

The M. W. Kellogg Company / *A Subsidiary of Pullman Incorporated* / **New York, Jersey City, Los Angeles, Tulsa, Houston, Toronto, London, Paris**

Industry Comes to Aetna

for two important reasons :

TO SAVE MAN HOURS, MACHINE HOURS AND MONEY

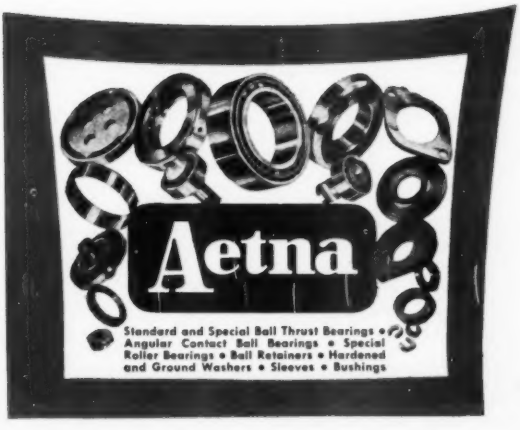
TO HELP GET THINGS DONE

Today the pressure for production is on. The welfare of our economy —or of an individual business—may depend upon a deeper search for time and money-saving methods.

Take your own plant, for example. Maybe there's a lot you could save—some bottlenecks you could break—by letting Aetna fabricate certain of your assembly parts . . . to your most exacting metallurgical, uniformity and tolerance specifications. You'll avoid troublesome raw material procurement problems, decrease the burden on over-loaded equipment, save man-hours and very likely reduce the delivered cost of your product to boot.

Aetna's mobilized facilities include the most modern equipment for stamping, piercing, machining, heat treating, ultra precision finish grinding plus complete engineering assistance, extensive tool and die facilities and over 35 years experience in serving leading manufacturers in the Automotive, Agricultural Equipment, Oil Field Equipment and General Industrial Fields.

NOW is a good time for YOU to find out how Aetna can help with your parts problems as well as your bearing problems. Write today!


Aetna
Standard and Special Ball Thrust Bearings • Angular Contact Ball Bearings • Special Roller Bearings • Ball Retainers • Hardened and Ground Washers • Sleeves • Bushings

AETNA BALL AND ROLLER BEARING COMPANY
4600 Schubert Avenue, Chicago 39, Illinois

How to keep joints in their place

Reminders of
Good Casing Practice
For mixed or unmarked strings, a drift or "jackrabbit" should be run through each length of casing when it is picked up from the catwalk and pulled onto the derrick floor, to avoid running a heavier length or one with lesser inside diameter than called for in the casing string.
(Reprinted by permission from "API Recommended Practice RP5C1: Care and Use of Casing, Drill Pipe and Tubing.")

MAKE EVERY JOINT A STRONG POINT

with Republic Electric Weld Casing

This modern casing tongs up to high joint strength . . . guards against costly pull-outs. Made by the improved Republic Electric Resistance Welding Process, it is uniformly round and uniform in wall thickness.

Joints have added pull-out strength because plenty of tough steel is left beneath thread roots at every point. Full-formed threads, solidly anchored in a uniform depth of tough steel, take hold with a bulldog grip.

Republic Casing offers extra resistance to severe external pressures, too. It is cold formed from high ductility steel . . . fully normalized for uniform wall structure . . . cold sized to further increase its high yield strength.

Every joint *is* a strong point when strings are run with Republic Electric Weld Casing and Tubing —field-proved by the many millions of feet which have been placed in service.

REPUBLIC STEEL CORPORATION
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N.Y.

REPUBLIC *Electric Weld*
NORMALIZED CASING AND TUBING

REPUBLIC STEEL

Other Republic Products include Line Pipe—Carbon, Alloy and Stainless Steels—Upson Studs, Bolts and Nuts—Electrunite Heat Exchanger Tubes

In this case it's refining, but whether the job be refining, pumping or transmission, you'll find Electric Power on the job — rendering safe, dependable, economical service. The top photo shows the new "cat" tower of a major oil company at Drumright, Okla. The bottom photo is a view of the refinery's storage facilities as seen from atop the tower. Here, as in countless other locales, Electric Power is doing the job Let *PEP go to work for you. Consult the Power Engineer of your nearest Electric Power Company for details on how you, too, can enjoy the many advantages of Electric Power.

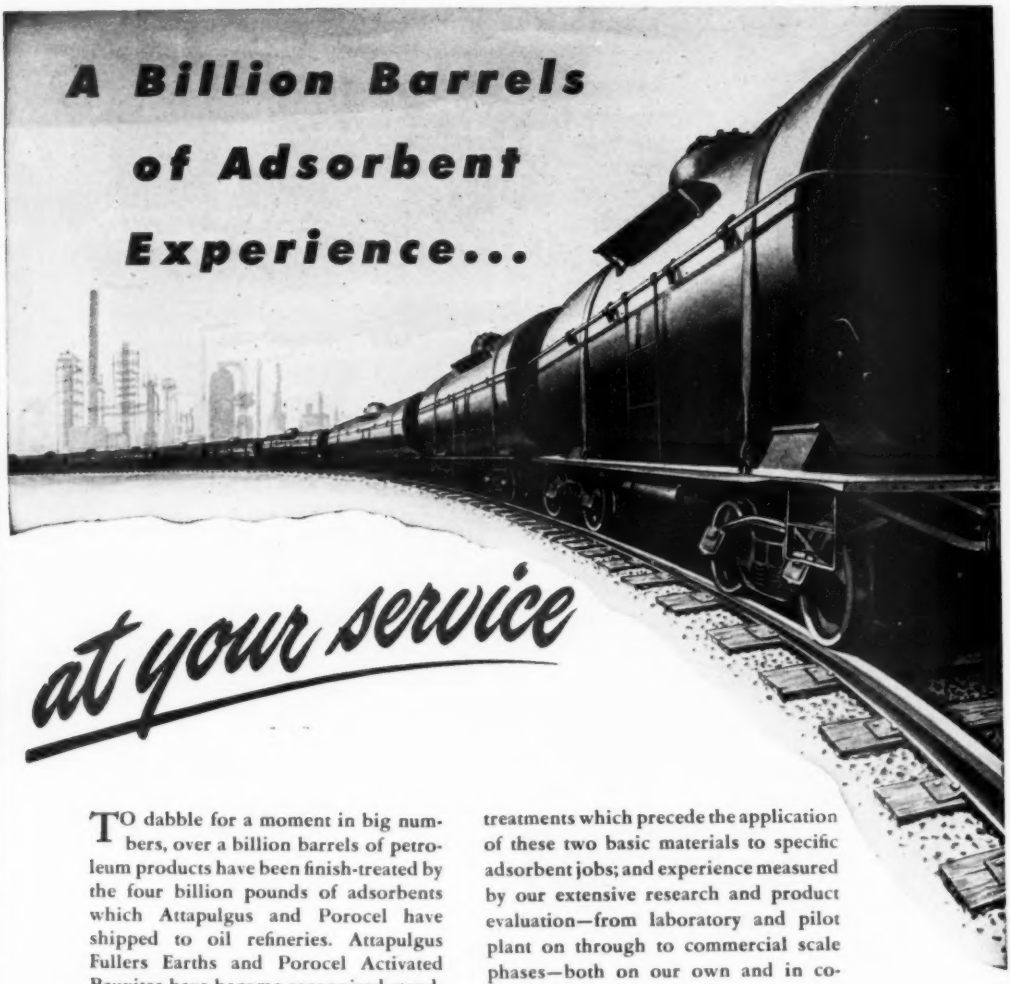
*PEP — Purchased Electric Power

Petroleum Electric Power Association

ORGANIZED IN THE INTEREST OF GREATER SERVICE TO THE PETROLEUM INDUSTRY

CALL YOUR NEAREST ELECTRIC SERVICE COMPANY FOR MORE FACTS
OR ADDRESS YOUR REQUEST TO P. O. BOX 2771, DALLAS, TEXAS

A Billion Barrels of Adsorbent Experience...



at your service

TO dabble for a moment in big numbers, over a billion barrels of petroleum products have been finish-treated by the four billion pounds of adsorbents which Attapulgus and Porocel have shipped to oil refineries. Attapulgus Fullers Earths and Porocel Activated Bauxites have become recognized standards in the removal or reduction of odors, colors, tastes, moisture, acids, sulfur, fluorides and unsaturates, and for solid catalyst purposes. And in this wide range of services, remarkable finished value was gained in a long list of petroleum cuts—from the lightest distillates to the heaviest lubes and waxes.

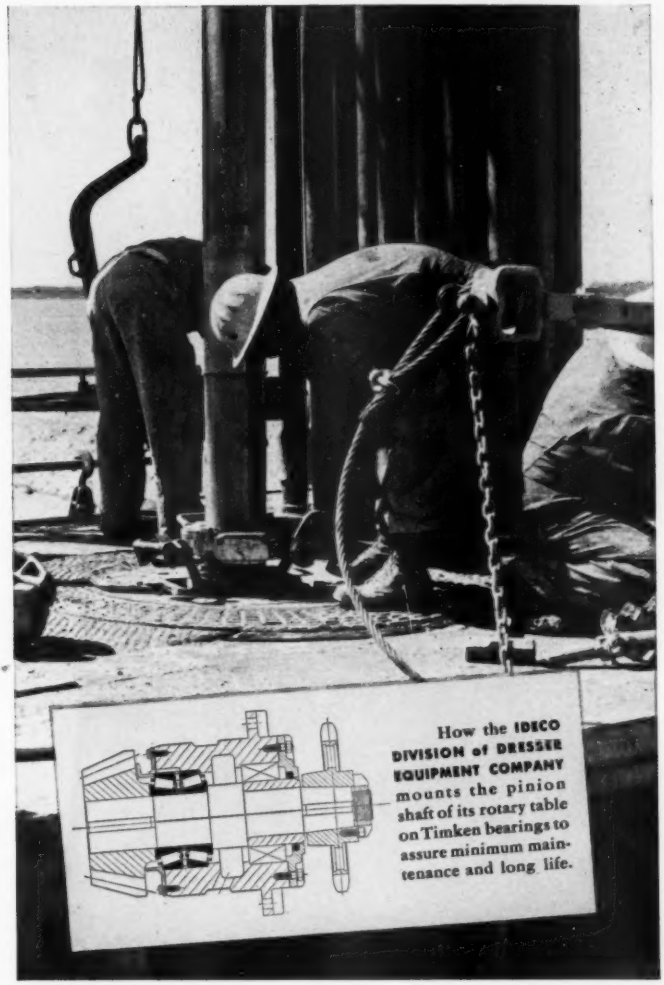
This all adds up to a lot of adsorbent experience—experience with the many treatments which precede the application of these two basic materials to specific adsorbent jobs; and experience measured by our extensive research and product evaluation—from laboratory and pilot plant on through to commercial scale phases—both on our own and in cooperation with our customers.

So there's great merit to the suggestion that it pays to consult Attapulgus and Porocel. In your own plans to improve products or expand output, perhaps our one billion barrels of adsorbent experience can be of real help to you in selecting the right adsorbent and the right conditions. Our laboratory and process staff are at your service, without obligation

ATTAPULGUS CLAY COMPANY *Fullers Earth* · **POROCEL CORPORATION** *Activated Bauxites*

Dept. V, 210 West Washington Square, Philadelphia 5, Pa.

How to help a drilling string avoid tie-ups



How the **IDECO DIVISION of DRESSER EQUIPMENT COMPANY** mounts the pinion shaft of its rotary table on Timken bearings to assure minimum maintenance and long life.

TO avoid frequent tie-ups for repairs and maintenance, Ideco mounts the pinion shaft of its rotary table on Timken® tapered roller bearings. Timken bearings take the heavy thrust of the pinion, hold the shaft in rigid alignment. Gear wear is reduced, equipment stays on the job.

The tapered construction of Timken bearings enables them to take radial and thrust loads or any combination. Line contact between the rollers and races of Timken bearings provides extra load carrying capacity. Shafts are kept in proper alignment.

Because they keep housing and shaft concentric, Timken bearings make closures more effective. Lubricant stays in—dirt stays out. Timken bearings are engineered for the job, precision manufactured and made of the finest steel ever developed for roller bearings—Timken fine alloy special analysis steel.

No other bearing can give you all the advantages you get with Timken bearings. Insist upon them in the oil field equipment you build or buy. Always look for the trademark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

DESIGN LEADERSHIP

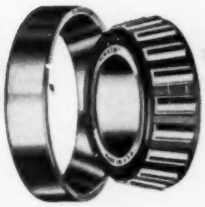
The first Timken tapered roller bearing was produced in 1898. Since then the one-piece multiple perforated cage, wide area contact between roller ends and ribs, and every other important tapered roller bearing improvement have been introduced by The Timken Roller Bearing Company.

The Timken Company leads in: 1. advanced design; 2. precision manufacture; 3. rigid quality control; 4. special analysis steels.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◫ AND THRUST →◫← LOADS OR ANY COMBINATION ✳

Bingham

PRECISION BUILT FIELD PROVEN PUMPS

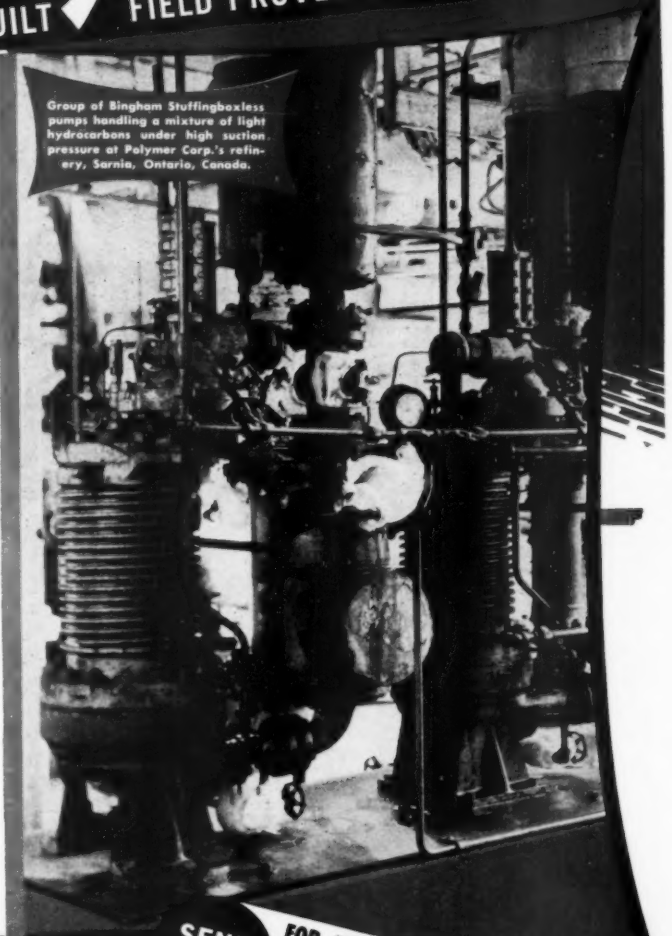
Stuffingboxless Pumps

Bingham Stuffingboxless Pumps are EXPLOSION PROOF and LEAK PROOF. This means SAFETY for plant personnel, PROTECTION against fire and PREVENTION against loss of valuable pumpage. These pumps can be furnished for any suction pressure...for any pumping temperature.

Bingham Stuffingboxless Pumps are especially adapted for and are giving exceptional service in many types of industry such as *Oil Refineries, Synthetic Rubber and Plastics industries, Natural Gasoline plants, Pipeline Booster stations, Terminal and Storage Tank Farms, Chemical plants, Food Processing industries, heavy construction and industrial applications.*

• • •

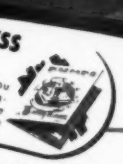
Bingham Stuffingboxless Pumps, like all Bingham products, are precision built in our new and modern plant. Each part is subjected to rigid inspection by expert craftsmen.



Group of Bingham Stuffingboxless pumps handling a mixture of light hydrocarbons under high suction pressure at Polymer Corp.'s refinery, Sarnia, Ontario, Canada.

SEND NOW FOR STUFFINGBOXLESS FOLDER NO. 107

Lists 12 important reasons why you can profit by using Bingham Stuffingboxless Pumps. Write, write, or phone the Bingham Sales and Service office nearest you.



Bingham — DOUBLE VOLUTE RADIAL BALANCE — PUMPS SINCE 1921

GENERAL OFFICES:
705 S.E. Main Street
Portland, Oregon

FACTORIES:
Portland, Oregon
Vancouver, Canada

Sales and Service Offices: BOSTON, MASS., 113 Broad Street • CHICAGO, ILL., 275 Old Colony Bldg., 407 South Dearborn Street • HOUSTON, TEX., 1206 Union National Bank Bldg. • MIDDLETON, OHIO, 505 Federal Savings & Loan Bldg. • NEW YORK CITY, N. Y., 611 Graybar Bldg., 420 Lexington Ave. • PITTSBURGH, PENN., 102 Mt. Lebanon Blvd. • SAN FRANCISCO, CALIF., 420 Market St. • SEATTLE, WASH., 316 Joseph Vance Bldg., 1402 Third Ave. • ST. LOUIS, MO., 2533 Salem • ST. PAUL, MINN., 205 South Robert St. • TULSA, OKLA., 200-206 N. Denver St. • VANCOUVER, CANADA, 3550 E. Broadway.

Make H_2SO_4 from H_2S

WITH A CHEMICO PLANT

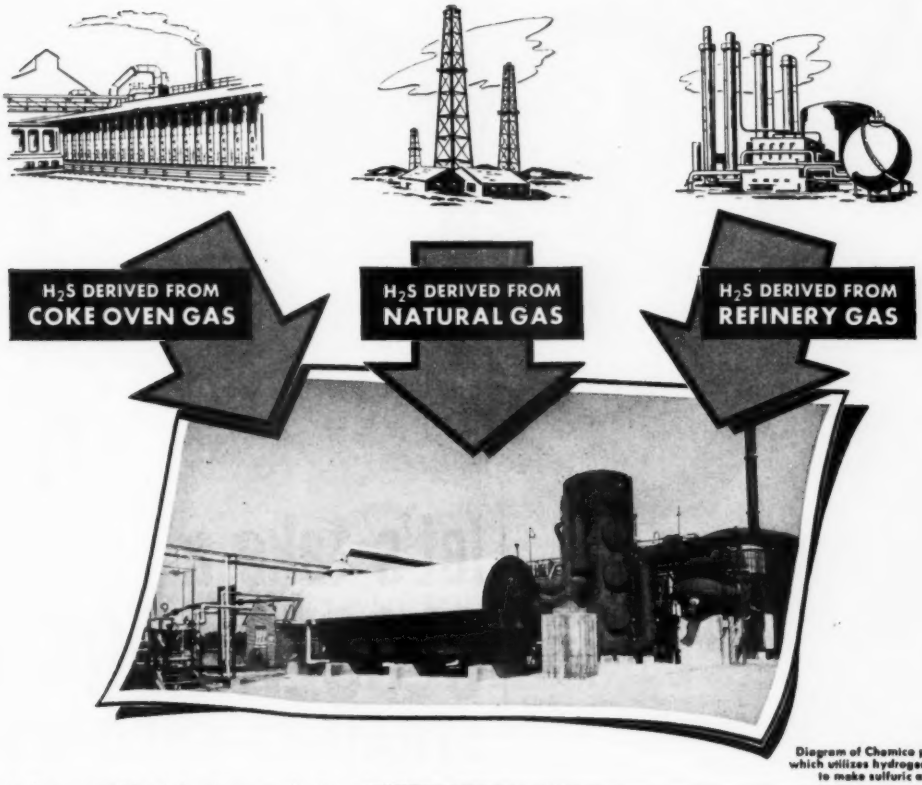
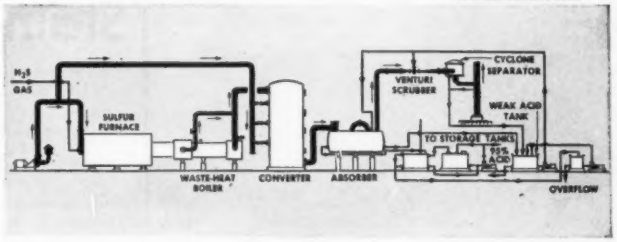


Diagram of Chemico process which utilizes hydrogen sulfide to make sulfuric acid.

Now that raw sulfur is in short supply, it has become necessary to manufacture sulfuric acid from other raw materials such as hydrogen sulfide. If you have hydrogen sulfide available, it will pay you to investigate Chemico's practical and proven process for making H_2SO_4 from H_2S. Chemico's new type sulfuric acid plant is especially well suited for this purpose. Or existing sulfuric acid plants can be converted.



CHEMICAL CONSTRUCTION CORPORATION

A UNIT OF AMERICAN CYANAMID COMPANY

488 MADISON AVENUE, NEW YORK 22, N. Y.

EUROPEAN TECHNICAL REPRESENTATIVE: CYANAMID PRODUCTS, LTD., LONDON W. C. 2, ENGLAND
CABLES: CHEMICONST, NEW YORK

CC219

Chemico plants are profitable investments

... let's take a

CLOSER LOOK at

STRAIGHT-CHROMIUM

Stainless Steel Tubing

Present restrictions on nickel have cut production of austenitic stainless steel tubing far below demand. If this critical shortage of nickel-bearing stainless tubing is compelling you to find other suitable grades, you should take a closer look at the straight-chromium analyses.

Readily available in quantity from B&W are pipe and tubes of the four non-nickel-bearing types listed below with typical uses. These ferritic and martensitic steels are magnetic at ordinary temperatures after all conditions of heat treatment, have relatively high oxidation resistance at elevated temperatures, and resist attack by many corrosive media. With certain modifications in procedures they can be satisfactorily fabricated by all methods applicable to austenitic grades.

For both pressure and mechanical applications, tubes of straight-chromium stainless analyses are worthy alternates for hard-to-get nickel-bearing stainless types. Would you like a copy of TDC-140 containing technical data on these easy-to-get grades of stainless tubes? Ask Mr. Tubes—your B&W Tube Representative — about their suitability for your applications.

APPLICATIONS

B&W Croloy 12 A1 (Type 405, Seamless) Non-hardening—does not undergo appreciable transformation; therefore no sudden volume change occurs during heating—corrosion and oxidation resistant. Typical uses: Conveyor lines in oil refining and chemical processing, heat exchanger tubing, boiler tubing in mercury heat cycle, catalytic oil cracking processes where fins have been welded to tubes.

B&W Croloy 12 (Type 410, Seamless and Welded) Hardenable—moderate corrosion and heat resistance. Typical uses: Machinery in the chemical and food processing and packaging fields.

B&W Croloy 18 (Type 430, Seamless and Welded) Sufficient ductility for forming simple parts—good corrosion and oxidation resistance—can be polished or buffed to pleasing finish. Typical uses: Conveyor lines in chemical processing field; condensers and piping in production, transportation, and storage of nitric acid and in nitrating operations involving mixed acids; furnace parts; retorts; ornamental structures.

B&W Croloy 27 (Type 446, Seamless) Corrosion resistant—excellent heat resisting qualities. Typical uses: Furnace parts, heat interchangers, kilns, pyrometer protection tubes, soot blower elements, dehydrogenation equipment in chemical and oil refining fields. Also well suited for glass sealing applications.

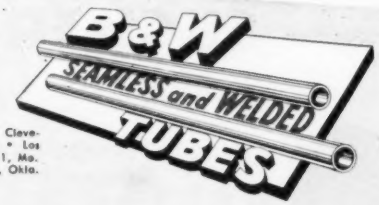
THE BABCOCK & WILCOX TUBE COMPANY

Executive Offices: **Beaver Falls, Pa.**

General Offices & Plants

Beaver Falls, Pa.—Seamless Tubing; Welded Stainless Steel Tubing
Alliance, Ohio—Welded Carbon Steel Tubing

Sales Offices: Beaver Falls, Pa. • Boston 16, Mass. • Chicago 3, Ill. • Cleveland 14, Ohio • Denver 1, Colo. • Detroit 26, Mich. • Houston 2, Texas • Los Angeles 17, Calif. • New York 16, N. Y. • Philadelphia 2, Pa. • St. Louis 1, Mo. San Francisco 3, Calif. • Syracuse 2, N. Y. • Toronto, Ontario • Tulsa 3, Okla.



TA-1651S

POINT NO. 4

EVERY JONES PONY ROD is made to the same high standards as Jones Sucker Rods. Pony rods undergo the greatest stress . . . lift the heaviest loads. Always use Jones Pony Rods with Jones Sucker Rods.

LOOK FOR THE GREEN RODS

JONES

SUCKER RODS

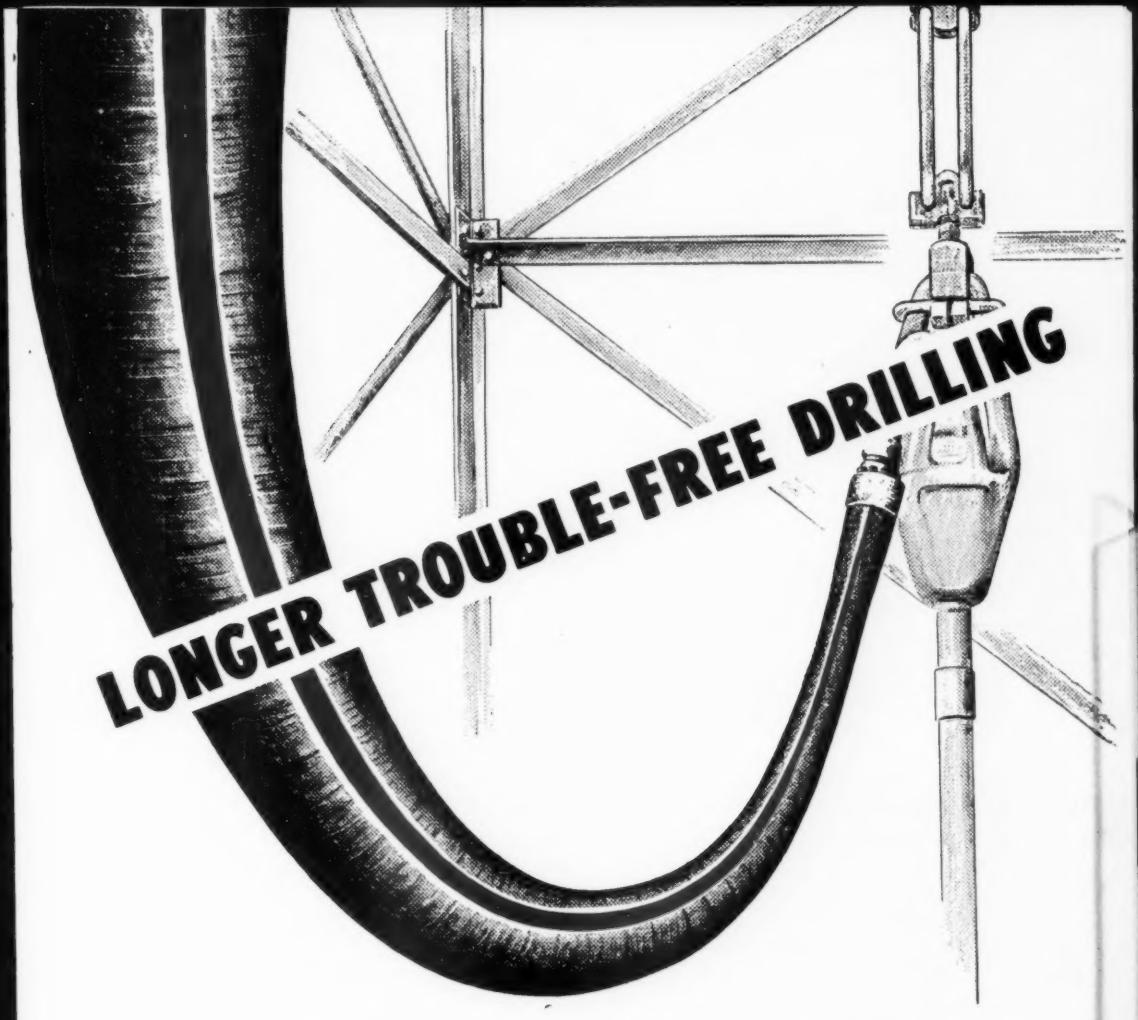
Best in the Field!

THE S. M. JONES COMPANY *Division of Buffalo-Eclipse Corporation*

General Office and Factory: TOLEDO, OHIO

SALES OFFICE:
Kennedy Building, Tulsa, Oklahoma

EXPORT SALES OFFICE:
Buffalo International Corp., 50 Church Street, N. Y. C.



RAY-MAN ROTARY HOSE

". . . Drills more hole than any rotary hose I've seen!" • This is typical of the good word for Ray-Man Rotary Hose that's going around among tool pushers. It's no coincidence that Ray-Man lasts so long. Ray-Man is far more flexible . . . easier to transport and make up without accident. It's a self-relaxing hose that hangs steady in the rig under high pumping pressure. • Couplings are built-in, streamlined, and blow-out proof. All this adds up to less strain—less wear—more drilling per hose.

Hose, V-belts, transmission belting, packing, engineered for all phases of the oil industry, are described in Catalog 6903. A copy will be mailed to you on request.

DISTRIBUTED BY NATIONAL SUPPLY COMPANY IN ALL PRINCIPAL OIL FIELDS

RM

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

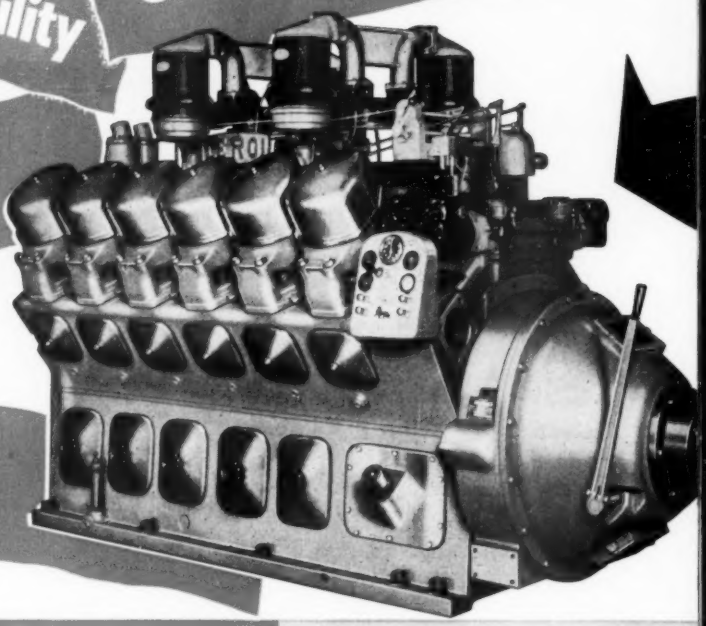
Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment • Radiator Hose • Fan Belts • Brake Linings • Brake Blocks • Clutch Facings • Packings • Asbestos Textiles • Powdered Metal Products • Abrasive and Diamond Wheels • Bowling Balls

Greater Accessibility

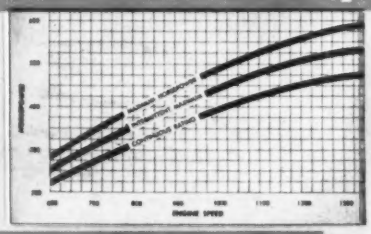
Greater Speed Range

Compactness

More Power

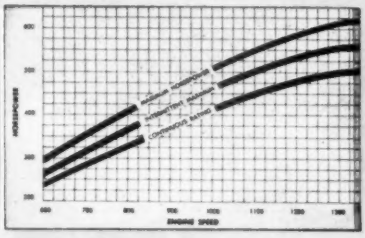


More Power—Wider Speed Range

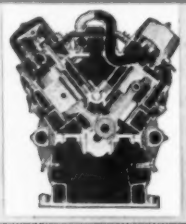


Gasoline or natural gas

Butane

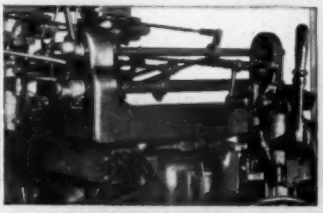


Faster Acceleration



Take a good look at the L-3460's V-12 design. Note the lightweight aluminum pistons, and short-radius rotating parts. You can see why the L-3460 gives you lightning-fast response to load demand.

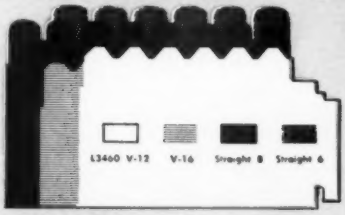
This governor will interest you, too. It is semi-hydraulic and responds instantly to load changes, whatever they may be.



More Compact—Easy Installation

LE ROI

Just compare the L-3460 with other designs of equal displacement. Remember too, the L-3460 complete with radiator, weighs only 12,200 lbs. That's why the L-3460 saves you installation time and money — is easier to move around.



LeRoi 600hp L-3460

EVERYTHING YOU ASKED FOR IN AN ENGINE

The L-3460, with its 600 maximum horsepower, is designed and built to meet oil-field demands for more power.

Its fast acceleration, wide speed range, lugging power at slow speeds, and compactness make it outstanding for drill-rig applications.

Its dependability and economy under continuous load, its space-saving size for easy installation, and its accessibility that simplifies maintenance give you an unbeatable power unit for any type of oil-field application — drilling, pipeline, generator drives, etc.

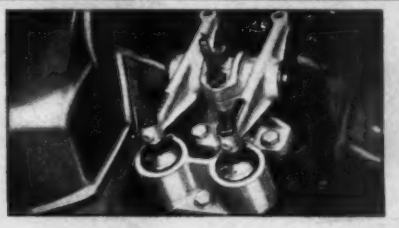
Here, in the L-3460, you have oil-field power at its best — wide speed range from 600 to 1350 rpm, and horsepowers from 350 to 600. If you want to keep a tight rein on costs, nothing but the best will do. So let the L-3460 go to work for you now — it's everything you asked for in an engine. For further information, see your Le Roi distributor — or write for our new bulletin E-3.

LE ROI COMPANY

MILWAUKEE 14, WISCONSIN

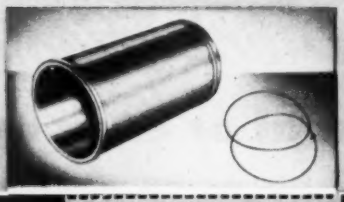
Plants: Milwaukee — Cleveland — Greenwich, Ohio • Oilfield Headquarters: Tulsa, Oklahoma

Easier Maintenance—Lower Costs



Valve-in-head design lets one man remove cylinder heads without disturbing manifold, carburetor, or controls.

One-piece crankcase and cylinder construction provides unusual rigidity — prevents misalignment. The L-3460 is built to take the punishment of oil-field handling.



Replaceable cylinder sleeves do away with costly reboring and expensive oversize parts.

P-104

LEADS THE FIELD

Le Roi Oilfield Sales

Oklahoma
Le Roi Company Branch — Tulsa
Carson Machine & Supply Co.— Oklahoma City

East & South Texas, Gulf Coast
Southern Engine and Pump Company — Houston, Kilgore, Edinburg, Dallas, San Antonio, Corpus Christi, Texas, and Lafayette, Houma, Louisiana.

North & West Texas, New Mexico
General Machine & Supply Co. — Odessa, Snyder, Texas.
Nortex Engine & Equipment Co.—Wichita Falls, Texas.

Kansas
Carson Machine and Supply Co.—Great Bend

Illinois — Western Kentucky
Western Machinery & Engine Company—Centralia, Illinois and St. Louis, Missouri.

LE ROI

IN THE FIELD . . .

Service Network

Michigan
Hafer Engine Service — Reed City

Rocky Mountain Area
Gehring Equipment Co. — Casper, Wyoming, Rangely, Col.

Northern Louisiana & Mississippi
Ingersoll Corporation — Shreveport, Louisiana, and Jackson, Mississippi.

West Coast
Le Roi-Rix Machinery Co. — Los Angeles, Long Beach and Bakersfield, Calif.

Appalachian Area
P. C. McKenzie Co., Pittsburgh

Canada
Lucey Export Ltd. — Calgary, Edmonton, Alberta.

No Lubrication Required...

for seal or easy operation...

Unlike conventional plug valves which must depend on viscous lubricant to effect a seal, Cameron Lift-Plug Valves require no lubrication yet they seal tightly and operate with extreme ease. Pressure forces and line strains which cause distortion in any valve body, cannot affect the geometry of the fit between the plug and seat in a Cameron Lift-Plug Valve. Consequently, no compensating lubricant is required. Maintenance is practically nil and the saving in valve lubricant expense is substantial.

Cameron NON-LUBRICATED **LIFT-PLUG VALVES**

CAMERON IRON WORKS, Inc. P. O. Box 1212 Houston, Texas

Export: 74 Trinity Place, New York, N. Y. Represented in sterling area by: British Oilfield Equipment Co., Ltd., Duke's Court, St. James's, London S.W. 1, England.

May your Christmas be happy and the New Year prosperous

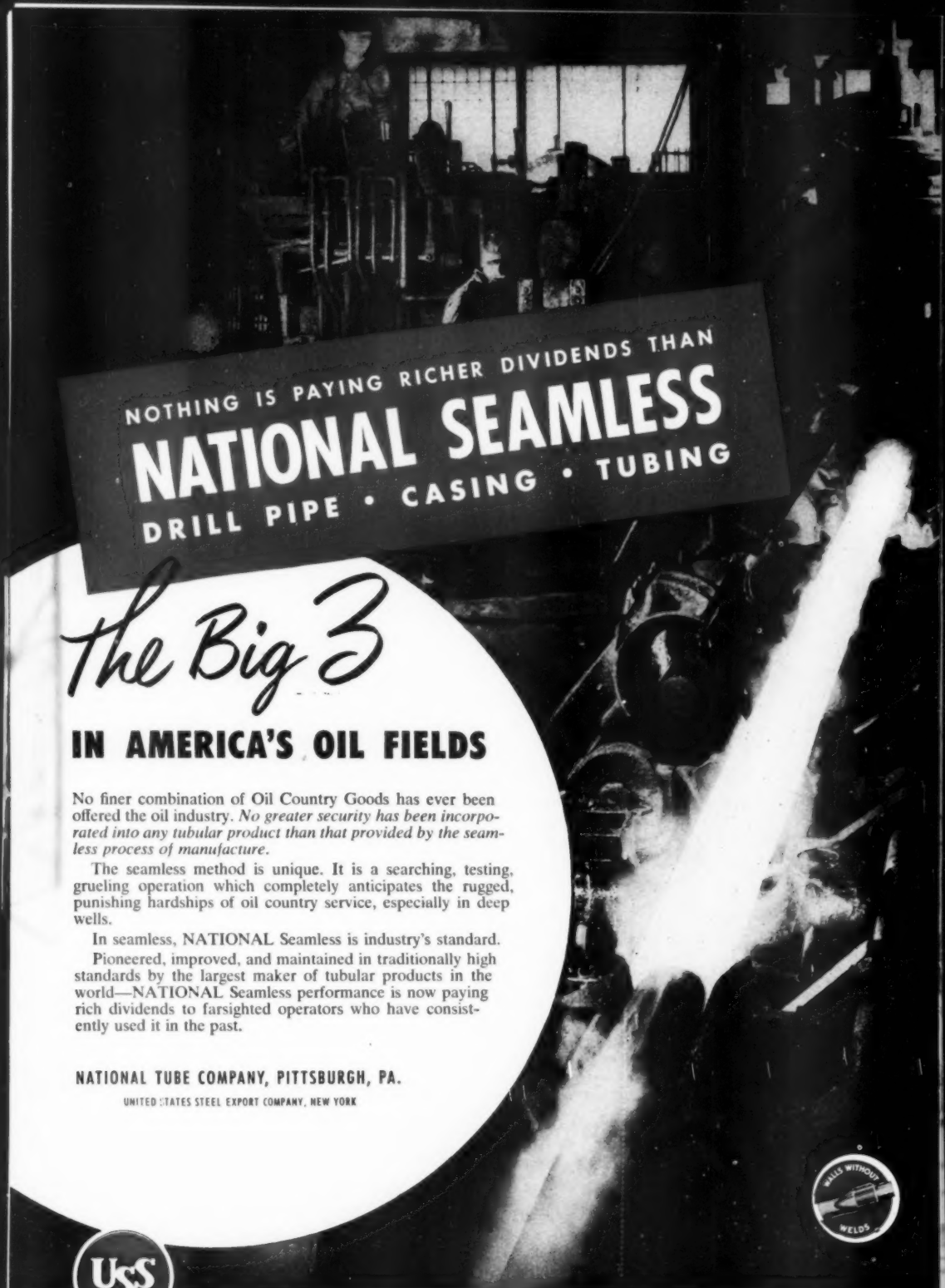
LUMMUS

THE LUMMUS COMPANY

385 MADISON AVENUE, NEW YORK 17, N. Y.

HOUSTON • CHICAGO • LONDON • PARIS • CARACAS

DESIGNING ENGINEERS AND CONSTRUCTORS FOR THE PETROLEUM AND CHEMICAL INDUSTRIES


NOTHING IS PAYING RICHER DIVIDENDS THAN
NATIONAL SEAMLESS
DRILL PIPE • CASING • TUBING
The Big 3
IN AMERICA'S OIL FIELDS
No finer combination of Oil Country Goods has ever been offered the oil industry. *No greater security has been incorporated into any tubular product than that provided by the seamless process of manufacture.*
The seamless method is unique. It is a searching, testing, grueling operation which completely anticipates the rugged, punishing hardships of oil country service, especially in deep wells.
In seamless, NATIONAL Seamless is industry's standard.
Pioneered, improved, and maintained in traditionally high standards by the largest maker of tubular products in the world—NATIONAL Seamless performance is now paying rich dividends to farsighted operators who have consistently used it in the past.
NATIONAL TUBE COMPANY, PITTSBURGH, PA.
UNITED STATES STEEL EXPORT COMPANY, NEW YORK
WELLS WITHOUT WELDS
USS
UNITED STATES STEEL

PETROLEUM CHEMICALS DIVISION
NEWS

December ★ One of a Series of Interest to the Petroleum Industry ★ 1951

Season's Greetings

to the

PETROLEUM INDUSTRY

PETROLEUM CHEMICALS DIVISION

Special Du Pont Paper Helps Seismic Prospectors Get Better Records

Oil prospectors want seismograph charts that point up the facts clearly and quickly . . . charts that are always easy to read and interpret.

Du Pont Seismograph Paper is specially made to help prospecting crews get better charts. It is a fast, high contrast recording paper with exceptionally wide latitude to permit rapid, easy processing at high temperatures, without loss of quality. And it is made to stand up under the tough, widely varying field conditions met by seismograph crews.

The paper is available in 50 to 200 foot rolls, in a wide range of widths.

Petroleum Chemicals District Office Managers Coordinate Many Du Pont Services to Help Refiners

BOTH BY nature and necessity, the typical Du Pont Petroleum Chemicals Division District Office Manager is a versatile individual.

He is required to know the answers to many questions. His desk is a limitless well of useful information for petroleum refiners and marketers. While very few oil men know him personally, he is always alert to their problems, always ready to coordinate the facilities of the Du Pont Company into helpful services for the Petroleum Industry.

WALTER MANSBERGER, office manager of the Gulf Coast District, handles many requests for service to refiners every day. He is one of the five Du Pont Petroleum Chemicals Division district office managers engaged in this work.

In much the same way as a control tower operator keeps traffic flowing smoothly at a busy airport, the District Office Manager coordinates the field work of Du Pont sales-service representatives. He knows where each man is working every day. And he is able to channel requests for technical assistance to the right man immediately . . . and switch men *en route* if the situation requires.

A comprehensive understanding of refinery problems is part of his job. To enable a representative to be most helpful at a tank cleaning, for example, the office manager must first get all the facts concerning the job . . . such information as tank size, repairs needed, and whether it is necessary to have the tank declared "lead-free."

THE "ANSWER MAN"! Answering questions on Du Pont products is sometimes like conducting an "Information Please" program—with the office manager as the genial MC. The questions concern everything from tank car deliveries to technical data of the most elaborate sort.

Although not necessarily an engineer or chemist, the office manager can always find the answer to the most technical question – by contacting the Du Pont Petroleum Laboratory, a district laboratory, the Chambers Works, or any of the many other Du Pont sources. He can also arrange to have a Du Pont specialist come to your plant to discuss specific problems. And in addition to petroleum chemicals, he frequently handles and properly channels requests for information on neoprene, explosives for seismic explorations, and many other Du Pont products used in the petroleum industry.

OVER

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

PETROLEUM CHEMICALS DIVISION
NEWS

CONTINUED *Office Manager*

MARKETING AIDS, TOO! Suppose a refiner desires to put on a dealer training meeting, or a demonstration for large fleet customers. Again, the Du Pont District Office Manager can be of help.

He will furnish an entertaining movie—booklets on gasoline quality—speakers and other promotion aids . . . with a highly instrumented Du Pont Test Fleet car, too, if that seems desirable. One of his "side lines" is helping to set up displays and demonstrations for schools and civic groups.

Everyone has heard that old adage, "When you want to get something done, ask a busy man." The next time Du Pont can be of service to *you*, just remember that the Petroleum Chemicals District Office Manager is *your* "busy man."

"The Customer Votes Every Day" Public Relations Man Stresses

HAROLD BRAYMAN, Director of Du Pont public relations, speaking at the Atlantic City NPA meeting, said: "By purchasing products or services of his own selection, the customer votes on business every day.

"These votes make big business big—yet the public constantly falls prey to the idea that bigness should be destroyed."

How can business overcome this malicious political idea?

"Most successful sales and promotional campaigns," Mr. Brayman continued, "are based on personal contact. Therefore, if business is going to win public understanding, it must take its fight right down to the small circle of contact surrounding a company's employees, stockholders, customers, neighbors and friends.

"If each company would make a real effort to tell the facts to those within sound of its own voice, I think we would be well on our way to better understanding.

"Once understanding is gained in each of these small circles of influence, the over-all effect will be such that business need fear no attack . . . because political groups are as sensitive to public opinion as business is to market votes," Mr. Brayman concluded.

Display Made For Oil Progress Week Available to Refiners For Showings

Five identical displays made for use by Du Pont Petroleum Chemicals Division district offices during Oil Progress Week are available to oil companies for special occasions.

The displays point out to the general public that petroleum is the source of many Du Pont products. These products in turn are fabricated by other manufacturers into consumer goods that benefit millions of people.

Each of the displays is made up of three panels. When assembled as a unit the display is 10 feet long and 5 feet high. It can be set up on legs to stand on the floor, or be shown without legs for window use.

The two side panels are demountable, as are the four product panels on each of them. This provides a flexibility that permits the display to be used in either large or small spaces.

Overhead lights are provided with the display and complete instructions for setting it up are included. Two men can erect the piece in eight minutes.

The nearest Du Pont Petroleum Chemicals Division district office will make the display available to oil companies on request.

"Pipeline on Wheels" A Public Relations Hit

Since the first public showing of "Pipeline on Wheels" at the Atlantic City NPA meeting in September, more than 100 prints of this new Du Pont color movie have been put into circulation.

The picture is designed to help oil companies prove to public officials, civic organizations and motorists that tank trucks for transporting gasoline are not the dangerous highway safety hazard which some people consider them to be . . . and that they are important to modern, motorized civilization.

The great number of requests for prints indicates an enthusiastic acceptance among oil men. Prints are loaned or sold to oil companies interested in using the film in their own training or public relations programs.

DU PONT
Better Things for Better Living . . . through Chemistry

Petroleum Chemicals

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Petroleum Chemicals Division • Wilmington 98, Delaware

District Offices: New York, N. Y. · Chicago, Ill. · Tulsa, Okla. · Houston, Texas · Los Angeles, Calif.

District Laboratories: Wilmington, Del. · Chicago, Ill. · Tulsa, Okla. · Houston, Texas · El Monte, Calif.

IN CANADA: Canadian Industries Limited — Toronto, Ontario — Montreal, Quebec

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

A-2699

Printed in U. S. A.

AMERICA NEEDS SCRAP — TO MAKE MORE STEEL — YOU CAN HELP

OUR ONE-STOP SUPPLY SERVICE *includes* J&L STEEL SHOT HOLE CASING

USE IT OVER AND OVER AND OVER AND OVER AND OVER AND OVER AND OVER AND OVER AND OVER

Use it over and over . . . it has an average pull-out strength of 15,000 lbs.

Jones & Laughlin Supply Company

A subsidiary of Jones & Laughlin Steel Corporation

J&L STEEL

EXPORT: 405 Lexington Ave., New York, N. Y., U.S.A.

General Offices: TULSA, OKLA.

82 Stores • 17 Offices • 7 Resident Salesmen

FASTER FIELD WELDING MEANS FASTER, EASIER PIPE LAYING

WITH CF&I WELDED STEEL PIPE

Men who work in the field with CF&I Welded Steel Pipe will tell you it can't be beat for faster and easier field welding.

That's because every length of CF&I pipe is made of special highly weldable steel... hydraulically tested and expanded for uniform size and roundness... precision bevelled at the ends for easy and accurate fit.

CF&I Welded Steel Pipe is offered in lengths of 40 feet and in overall diameters from 24 inches through 36 inches. Write for complete information to Claymont Steel Corporation, Claymont, Delaware.

Flanged and Dished Heads . . . Carbon and Stainless-Clad Steel Plates

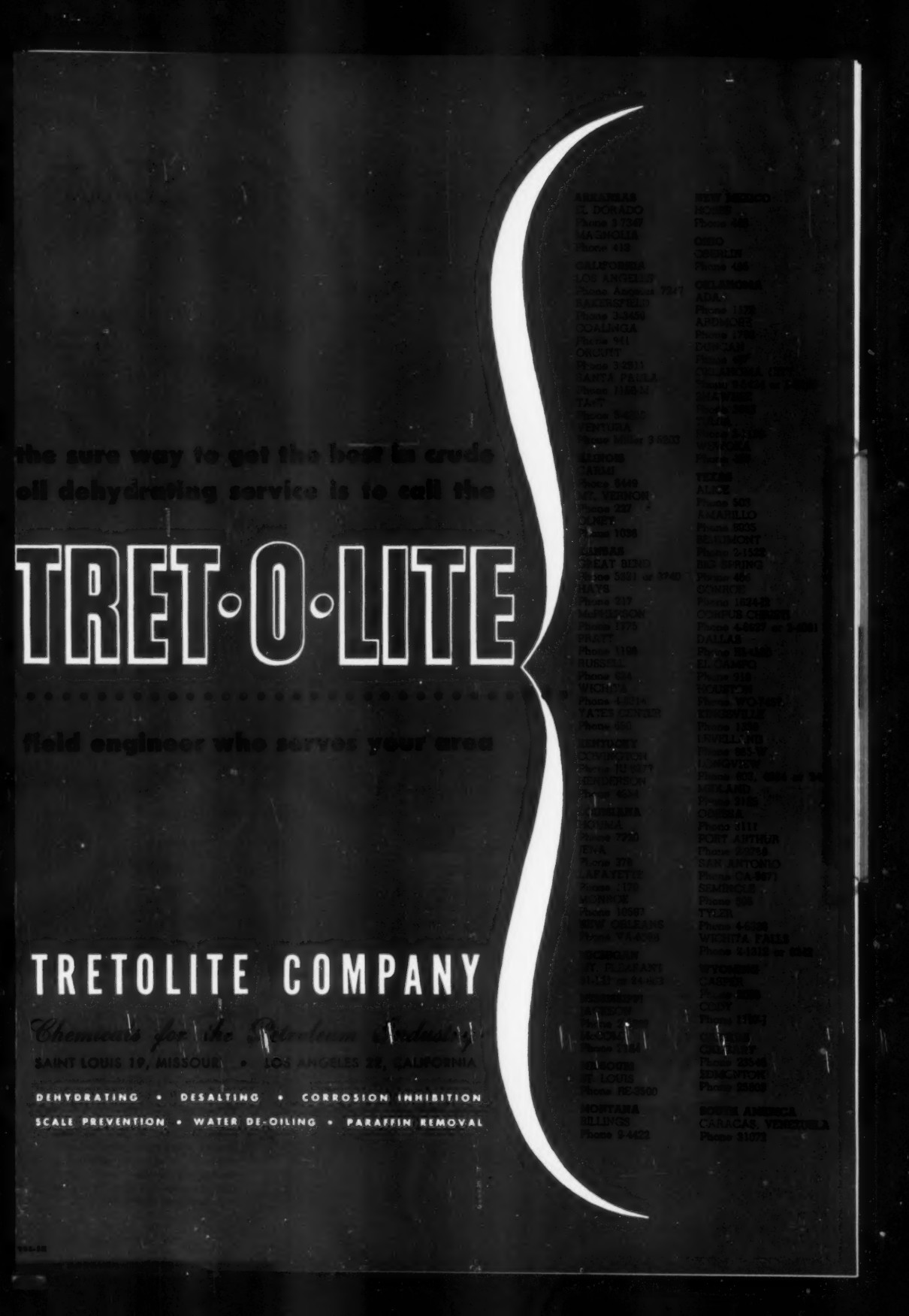
CF&I

WELDED STEEL PIPE

PRODUCT OF

CLAYMONT STEEL CORPORATION

SUBSIDIARY OF THE COLORADO FUEL AND IRON CORPORATION


the sure way to get the best in crude
oil dehydrating service is to call the
TRET·O·LITE
field engineer who serves your area
TRETOLITE COMPANY
Chemicals for the Petroleum Industry
SAINT LOUIS 19, MISSOURI • LOS ANGELES 22, CALIFORNIA
DEHYDRATING • DESALTING • CORROSION INHIBITION
SCALE PREVENTION • WATER DE-OILING • PARAFFIN REMOVAL

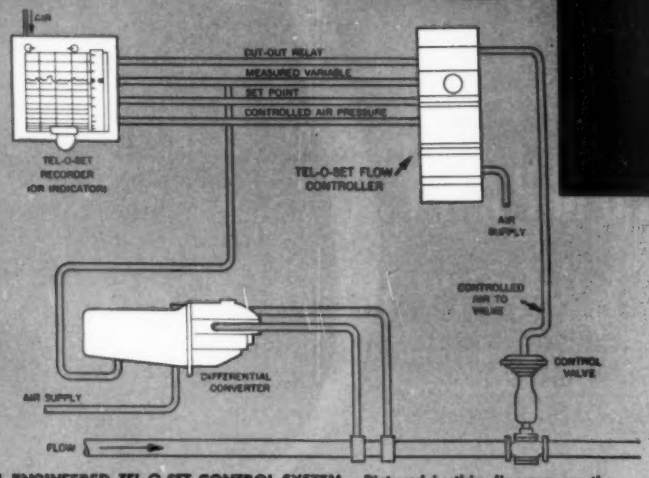
Important

TEL-O-SET CONTROLLER

Available in adjustable and fixed proportional band models, and with three control forms . . . for flow, temperature, pressure, level and other process variables. Universal bracket permits optimum flexibility in mounting . . . coded, interchangeable sections and split manifold contribute to simplified maintenance. Write for Specification Sheet No. 768.

TEL-O-SET RECORDER

Features withdrawal of chassis for full 8-hour chart visibility without interrupting operations, bumpless shifting from automatic to manual operation, all adjustments from front of panel, built-in adjustable restrictions for pulsating flow . . . requires panel space just 5$\frac{1}{16}$" high by 5" wide. Write for Specification Sheet No. 769.



TYPICAL ENGINEERED *TEL-O-SET* CONTROL SYSTEM—Pictured in this diagram are the elements of the *Tel-O-Set* Family, designed and built as an integrated loop. Here the system is applied to the control of flow with the *Differential Converter* used as transmitter.

TEL-O-SET INDICATOR

Can be used with any pneumatic transmitter, having a 3-15 psi controlled air output, regardless of the primary element being used. Provides indication of process variable, set-point of controller or controlled air pressure to valve when on automatic control . . . is easily shifted to manual operation. Panel cut-out size same as recorder. Write for Specification Sheet No. 770.

Contribution to Process Control

. . . THE HONEYWELL TEL-O-SET FAMILY

THIS pace-setting pneumatic control system is ready for application to a host of processes demanding a new high in speed, precision and accuracy . . . for almost any process variable. Developed as part of a family relationship, each unit complements the others in producing a system of superior performance.

Used with any one of a group of Honeywell measuring elements . . . for flow, temperature, pressure, liquid level, etc. . . . the *Tel-O-Set* system is destined to make important contributions to the improvement of process control throughout industry.

For more detailed information, send for the literature mentioned in the descriptions at left . . . or call in our local engineering representative for a discussion of your process control problems.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4488 Wayne Ave., Philadelphia 44, Pa.

MINNEAPOLIS **Honeywell**

Brown Instruments

H HONEYWELL

Thermoid
Industrial Rubber Products
Quality Value Service

Multi-V Belts For Tough Oil Field Service

Here's a cost-cutting combination! Thermoid Multi-V Belts . . . Rotary Hose . . . Mud-Flow Suction Hose . . . Flexible Discharge Units.

The going is tough for any equipment in oil field service. But not too tough for Thermoid Multi-V Belts!

Thermoid Multi-V Belts are pre-stretched to insure maximum power transmission without adjustment. They are constructed for flexibility and for ability to absorb repeated shocks—thoroughly impregnated with special rubber compounds to withstand moisture and abrasion. The result is longer belt life.

Thermoid Multi-V Belts are available in matched sets... uniform in size and cross section. Their longer life and non-slip performance add up to the lowest possible cost in any service.

Thermoid Multi-V Belts reflect the same care in manufacturing... the same constant research aimed at product improvement ... that have made Thermoid Products the standard of performance in the oil fields.

Mid-continent Office and Warehouse: Houston, Texas

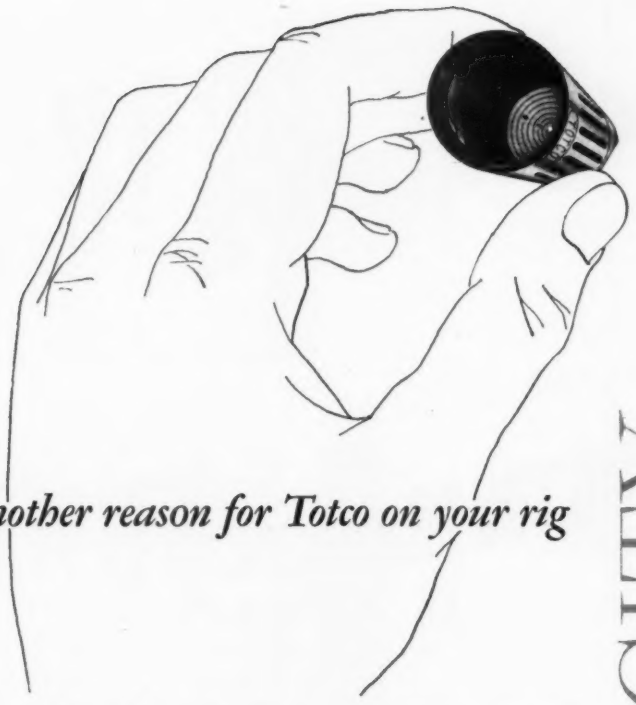
SEE OUR CATALOG IN THE COMPOSITE CATALOG

Powerflex Rotary Hose • Trioflex Slim-Hole Rotary Hose • Mud-Flo Slush Pump Hose • Flexible Discherge Units • F.H.P. and Multiple V-Belts • Oil Country Flat Belting

Thermoid

Wire Line Turn Backs • No-Wip Line Savers • Stuffing Box Rings • All Types of Hose • Molded Specialties • Brake Blocks

Thermoid Company • Offices & Factories: Trenton, N. J., Nephi, Utah



—another reason for Totco on your rig

SIMPLICITY

There's no other drift indicator as simple and as fool proof as your TOTCO Recorder. Infinitely detailed in design ...Sure! But simple to run and simple to read. Anyone can do it and know it's right.

There's no involved procedure—no batteries, chemicals or ink pots—just an accurate, dependable mechanical instrument that's known and preferred in oil fields the world over. If you find your present equipment a bit complicated you'll appreciate TOTCO'S unparallelled simplicity.

Be **SURE** *you know, use* **TOTCO**

YOU CAN TAKE TOTCO READINGS ANYTIME

Run in and out on measuring line.

Dropped down drill pipe; picked up with core barrel overshot.

Dropped down drill pipe; recovered when bit is changed.

Run in the Recorder connected to a core barrel overshot when picking up a retractable core barrel.

Run in and out on ordinary sand line.

TOTCO *Recorder*

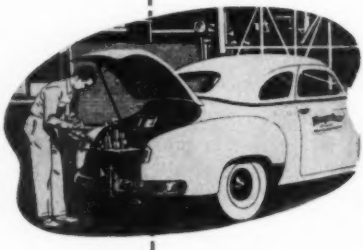
Technical Oil Tool Corp., Ltd.
1057 N. La Brea Ave., Los Angeles 38, Calif.

Exclusive Distributors:

California—Republic Supply Company of California
Domestic—Continental Supply Company
Canada—Oil Well Supply Company
Export—Lucey Export Corporation, New York.

MUD CAN PLAY A BIG PART IN HELPING YOU DRILL MORE WELLS

With Less Pipe in 1952



Magcobar
Complete
DRILLING MUD SERVICE
DEALER

Although practically every well drilled in the past 15 years has required some type of controlled drilling fluid, mud can now play an even bigger role in the drilling of your future wells. It has now been proved that many formations which formerly required protective casing strings can be completely and safely protected by Magcobar muds and chemicals. Yes, you can now often use protective mud to replace protection casing . . . which in turn enables you to drill more wells with your 1952 casing allocations. Why not talk to your Magcobar field engineer now about the possibility of using protective mud to stretch your casing allocations. Magcobar's complete line of drilling mud products is available through more than 350 dealers throughout the United States and Canada.

MAGNET COVE BARIUM CORPORATION

ONE OF THE DRESSER INDUSTRIES

HOUSTON, TEXAS • MALVERN, ARKANSAS

These tubes go in to stay!

Thanks to CHASE ANTIMONIAL ADMIRALTY

(a patented alloy)

Here's the reason Chase Antimonial Admiralty* keeps heat exchanger tubes on the job year after year:

They've got *enough* antimony to resist dezincification. And antimony will not affect the metal's grain structure and won't weaken the tube.

When you get Chase Antimonial Admiralty Condenser Tubes, you're getting metal that *stays tough* . . . stands up under heavy stresses . . . lasts for years.

Years of use have proved Chase Antimonial Admiralty's superiority!

*U. S. Pat. No. 2,061,921

Special stocks of
ANTIMONIAL ADMIRALTY
Condenser Tubes in Chase Warehouses:
NEW YORK, BALTIMORE, NEW ORLEANS
LOS ANGELES
also carried by—
Vinson Supply Co., Tulsa
Standard Brass & Mfg. Co., Houston

Chase BRASS & COPPER

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

CHASE 75th ANNIVERSARY 1876 1951

• *The Nation's Headquarters for Brass & Copper*

Albany†	Cleveland	Kansas City, Mo.	New York	San Francisco
Atlanta	Dallas	Los Angeles	Philadelphia	Seattle
Baltimore	Denver†	Milwaukee	Pittsburgh	Waterbury
Boston	Detroit	Minneapolis	Providence	
Chicago	Houston†	Newark	Rochester†	(†sales office only)
Cincinnati	Indianapolis	New Orleans	St. Louis	

Find the one nearest you . . . it will pay you to know him

. . . HE'S YOUR

G-E COMMUNICATIONS MAN—

J. W. Bryant, A. C. Altobellis
ATLANTA
187 Spring Street, N. W.
Walnut 9767

J. T. Harrington
BOSTON
963 Com'nwealth Ave.
Hubbard 2-1800

R. P. White
CHARLOTTE
1300 Berryhill Rd.
Phone 55244

H. N. McNeill
CHICAGO
1122 Mdse. Mart
Whitehall 4-3915

J. B. Warren
CINCINNATI
215 W. 3rd St.
Parkway 3431

M. S. McIlwain, R. V. Kinney
CLEVELAND
710 Williamson Building
Superior 6822

J. W. Randel, G. F. Reed
DALLAS
901 Ross Avenue
Prospect 4296

R. W. Robinson

F. D. Morton
DENVER
650 17th Street
Keystone 7171

C. F. King, R. L. Casselberry
DETROIT
2511-13 Book Tower
Woodward 3-3601

L. Peine
HOUSTON
4604 S. Main St.
Justin 0657

E. L. Dodge
INDIANAPOLIS
110 N. Illinois St.
Lincoln 6531

G. P. Foster, C. G. Turner
KANSAS CITY
106 W. 14th Street
Victor 9745

K. J. Warthen
LOS ANGELES
530 W. 6th St.
Trinity 3417

W. G. Pree
MINNEAPOLIS
12 S. Sixth Street
Main 2000

M. F. Chapin
NEW ORLEANS
339 Int'l. Trade Mart
Tulane 5871

F. S. Bunce
NEW YORK
570 Lexington Ave.
Plaza 5-1311

R. W. Massey
OKLAHOMA CITY
418 Terminal Bldg.
Phone 79-1215

F. M. Girard
PHILADELPHIA
1405 Locust Street
Pennypacker 5-9000

H. W. Chew
ST. LOUIS
4227 Lindell Blvd.
Chestnut 8505

L. R. Sheeley, F. I. Deetken
SAN FRANCISCO
235 Montgomery Street
Douglas 2-3740

J. E. Hogg
SEATTLE
710 Second Ave.
Seneca 8300

H. M. Wales, J. F. Conley
SYRACUSE
113 South Salina Street
Phone 76-4411

L. W. Goostree, I. M. Ellis
SYRACUSE
Electronics Park
Phone 76-4411

N. F. Harmon
SYRACUSE
Electronics Park
Phone 76-4411

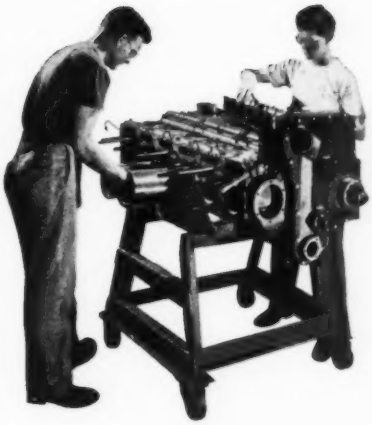
G. R. Odom, W. R. Sinbock
WASHINGTON, D. C.
806 15th Street, N. W.
Executive 3600

R. J. Brown

● For complete information and specifications on General Electric 2-way radio or microwave equipment—ask him—or write: *General Electric Company, Section 8111-22, Electronics Park, Syracuse, New York.*

You can put your confidence in—

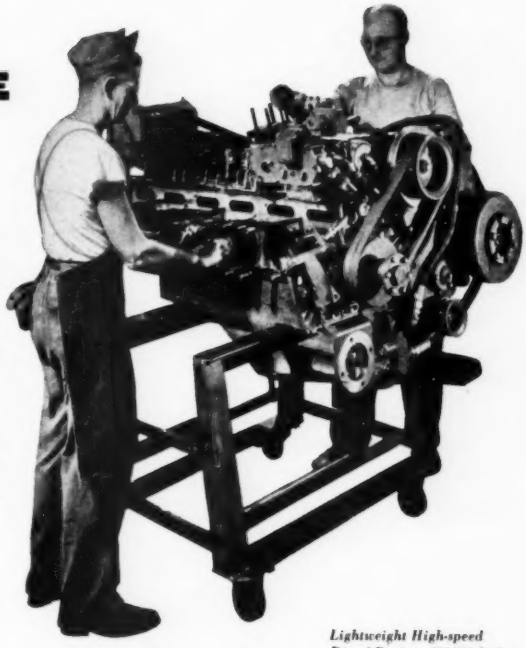
GENERAL ELECTRIC



Cummins®
CUSTOM BUILT
Diesels

BUILT NOT ONCE BUT TWICE

You get more power and profits with Cummins Diesels. They're custom-built to fit your job, and your equipment. And they are literally built *not once but twice.* Each engine is assembled, run-in tested, disassembled . . . inspected, reassembled and *tested* again. Such precision building, Cummins exclusive fuel system, efficient service and parts organization . . . mean *less* "down-time" and *more* profitable power from every Cummins Diesel Engine. *See your Cummins dealer.*



Lightweight High-speed Diesel Engines (50-550 hp)
for: on-highway trucks
off-highway trucks • buses
tractors • earthmovers
shovels • cranes
industrial locomotives
air compressors
logging yarders and loaders
drilling rigs
centrifugal pumps
generator sets and power units
work boats and pleasure craft

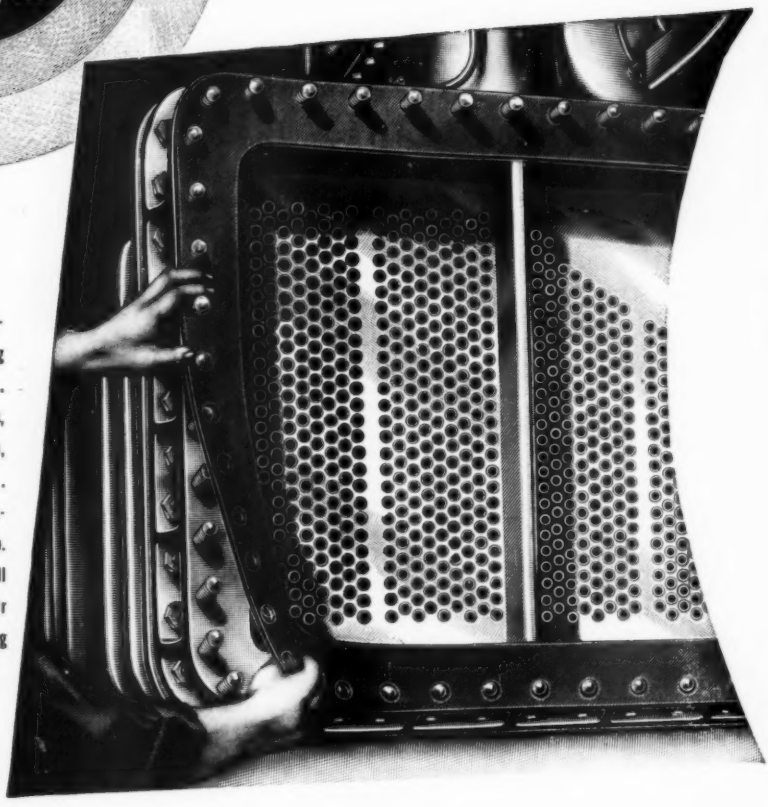
CUMMINS ENGINE COMPANY, INC., COLUMBUS, INDIANA
Export: CUMMINS DIESEL EXPORT CORPORATION Columbus, Indiana, U.S.A. • Cable: CUMDIEX

Diesel power by CUMMINS

CUMMINS Diesel DIESEL

TRADEMARK REG. U. S. PAT. OFF. ●

IT'S PACKED WITH SATISFACTION WHEN IT'S PACKED WITH R/M



Gaskets like this for Freon condensers may not be your packing problem, but whatever it is . . . high pressures, high temperatures, chemicals, refrigerants, petroleum, food or other products . . . Raybestos-Manhattan has a packing or gasket designed for the job. Your nearby R/M distributor will help you solve your problem. Or write for the new R/M Packing Catalog.

R/M

PACKINGS

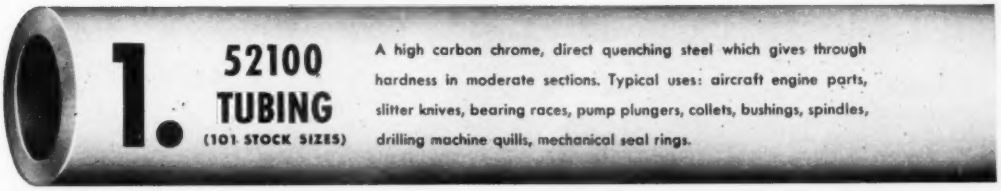
RAYBESTOS-MANHATTAN, INC.

PACKING DIVISION, MANHEIM, PA.

FACTORIES: Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Passaic, N.J.

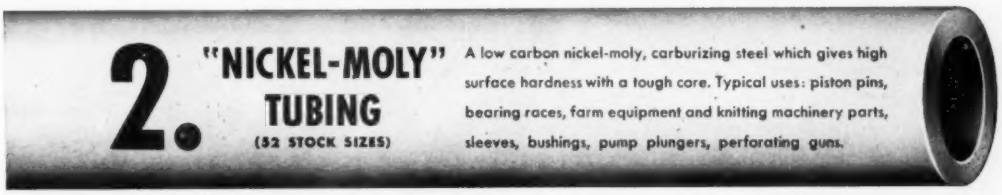
RAYBESTOS-MANHATTAN, INC., Manufacturers of Packings • Asbestos Textiles • Mechanical Rubber Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings • Fan Belts • Radiator Hose • Powdered Metal Products • Bowling Balls

Immediate delivery on warehouse lots of 2 TIMKEN® steels that do 90% of your hollow parts jobs!



1. 52100 TUBING
(101 STOCK SIZES)

A high carbon chrome, direct quenching steel which gives through hardness in moderate sections. Typical uses: aircraft engine parts, slitter knives, bearing races, pump plungers, collets, bushings, spindles, drilling machine quills, mechanical seal rings.



2. "NICKEL-MOLY" TUBING
(52 STOCK SIZES)

A low carbon nickel-moly, carburizing steel which gives high surface hardness with a tough core. Typical uses: piston pins, bearing races, farm equipment and knitting machinery parts, sleeves, bushings, pump plungers, perforating guns.

NEED steel tubing in a hurry for your hollow parts jobs? These two Timken® steels may help you. They'll do about 90% of your hollow parts jobs. And we can give you immediate delivery on warehouse lots.

Timken 52100 and "Nickel-Moly" steels are general purpose steels which have good hardenability and wear resistance. Timken 52100 steel can often be substituted for costlier steel. It can be heat treated to file hardness and tempered back to any desired point. In moderate sections, it is through-hardening. There are 101 sizes of 52100 tubing ranging from approximately 1" to 10½" O.D.

"Nickel-Moly" is a fine-grained carburizing steel with exceptional stamina and shock absorbing qualities when heat treated. It develops high case hardness and a tough core. It is available in 52 sizes, ranging from approximately 1⅜" to 10¼" O.D.

With both these steels, you're sure of top quality and uniformity—from tube to tube and order to order—because of the Timken Company's rigid quality controls. Write on your company letterhead for stock list. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

Specialists in alloy steel—including hot rolled and cold finished alloy steel bars—a complete range of stainless, graphitic and standard tool analyses—and alloy and stainless seamless steel tubing.

. . . Go Hand in Hand

. . . toward meeting the needs of a nation! For the three are vital links in the chain of progress.

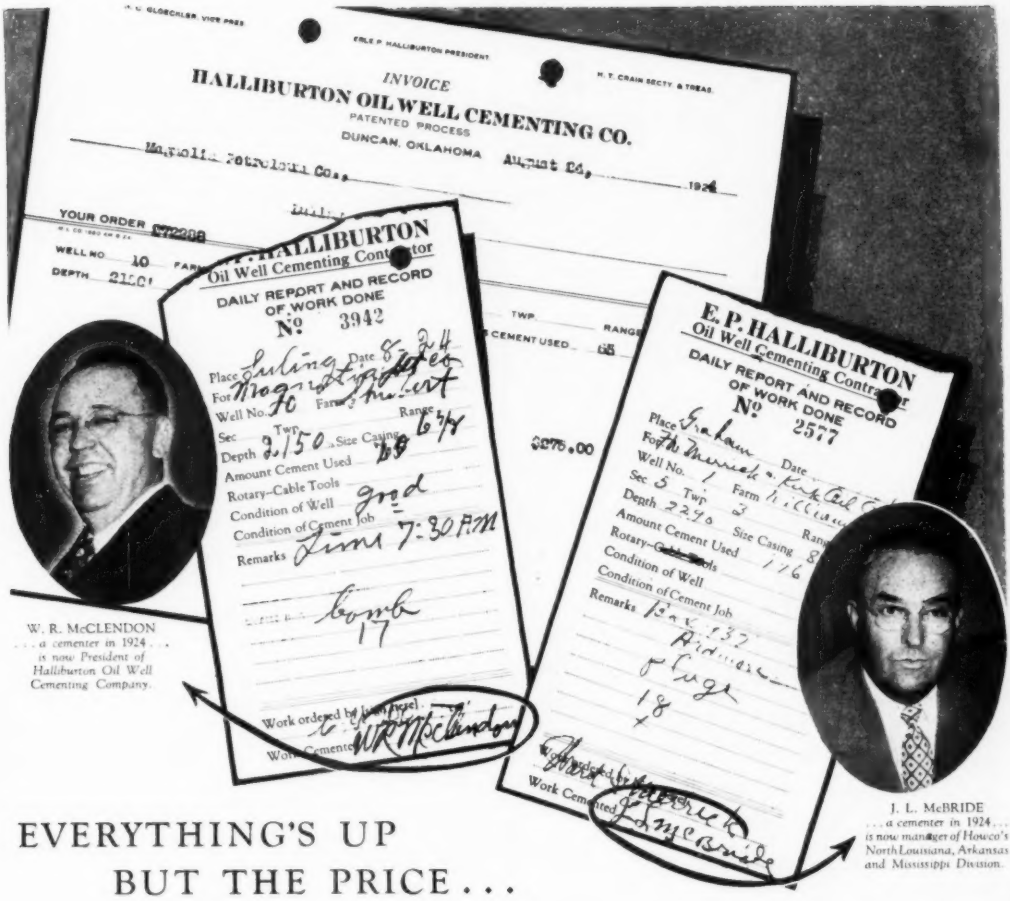
The needs of the Petroleum Industry are met in the field and Mid-Continent is proud of its record of Service and Supply to the industry . . . its conveniently located field stores, with the gleaming neon oil spouting derrick on top, are landmarks in oil producing areas—landmarks that oil men know mean the finest in Service, the best in Supplies.

MID-CONTINENT
Supply Company

Around the CLOCK
Around the WORLD
SERVICE!

The World's Largest Independent Oil Field Supply Company

General Offices, Mid-Continent Building FORT WORTH, TEXAS


INVOICE
HALLIBURTON OIL WELL CEMENTING CO.
PATENTED PROCESS
DUNCAN, OKLAHOMA
HALLIBURTON
Oil Well Cementing Contractor
DAILY REPORT AND RECORD OF WORK DONE
No. 3942
E. P. HALLIBURTON
Oil Well Cementing Contractor
DAILY REPORT AND RECORD OF WORK DONE
No. 2577
W. R. McCLENDON
. . . a cementer in 1924 . . . is now President of Halliburton Oil Well Cementing Company.
J. L. McBRIDE
. . . a cementer in 1924 . . . is now manager of Howco's North Louisiana, Arkansas and Mississippi Division.

EVERYTHING'S UP BUT THE PRICE . . .

The men have gone up. W. R. McClendon, a cementer in 1924, is now President of the Halliburton Company. J. L. McBride, also a cementer in 1924, is now manager of Howco's North Louisiana, Arkansas, and Mississippi Division.

The cost of cementing trucks has gone up—from $6,000 in 1924 to more than $50,000 today.

Cementers' wages have gone up by more than 70%.

Only one element of a cementing job has gone down. The price of the average job today is less than it was in 1924!

Erle P. Halliburton

Chairman of the Company

HALLIBURTON OIL WELL CEMENTING CO.
Duncan, Oklahoma

BLAW-KNOX *Announces...*

new tailor-made high capacity natural gas dehydration plants

OPERATING CONDITIONS

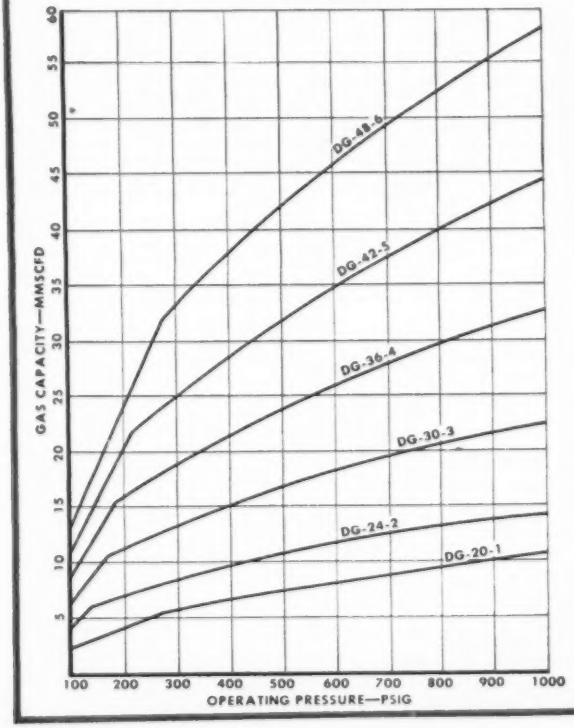
Gas Capacity at 500# and 1000# Operating Pressures for Blaw-Knox Standard Glycol Dehydration Units

Model No.	Max. Gas Capacity MMSCFD	Inlet Gas Temp. °F	Inlet Gas Press. PSIG	Dew Point Depression °F	Pressure Drop Thru Unit PSI
DG-20-1	7.3	80°	500	50°	3
DG-24-2	10.5	80°	500	50°	3
DG-30-3	16.6	80°	500	50°	3
DG-36-4	23.7	80°	500	50°	3
DG-42-5	32.0	80°	500	50°	3
DG-48-6	42.0	80°	500	50°	3
DG-20-1	10.5	80°	1000	50°	3
DG-24-2	14.5	80°	1000	50°	3
DG-30-3	22.7	80°	1000	50°	3
DG-36-4	32.5	80°	1000	50°	3
DG-42-5	44.7	80°	1000	50°	3
DG-48-6	58.0	80°	1000	50°	3

GAS CAPACITY OF BLAW-KNOX STANDARD GLYCOL DEHYDRATION UNITS VS. OPERATING PRESSURE IN PSIG

Inlet Gas Temp. 80°F Guaranteed Depression 50°F

Pressure Drop Thru Unit 3 PSI



Blaw-Knox now offers a line of natural gas dehydration plants that benefit from the economics and proved efficiencies in operation obtained by standard design, but which are flexible enough to meet the exact requirements of each customer's needs.

Check the adjoining table and chart for operating characteristics of the various models against your own requirements. A Blaw-Knox engineer will be glad to give you further data.

Blaw-Knox plants are . . .

1. Tailor-made to fit your exact requirements based on a standard process and the use of standard parts and subassemblies.
2. Blaw-Knox high capacity natural gas dehydration plants are flexible because they are skid-mounted, prefabricated and assembled.
3. All Blaw-Knox high capacity natural gas dehydration plants are accessible, can readily be disassembled for maintenance. Individual components are interchangeable and the design features inherent flexibility.
4. Guaranteed to meet performance specifications which are based on actual field and engineering calculations.
5. Reliable. These units have long life and require a minimum of maintenance. Ask any of the Blaw-Knox satisfied customers.

CHEMICAL PLANTS DIVISION

BLAW-KNOX CONSTRUCTION CO.

PITTSBURGH • TULSA • NEW YORK
PHILADELPHIA • CHICAGO
BIRMINGHAM • WASHINGTON, D. C.

they never sleep

This pumping station is typical of scores of crude oil and oil products' pipe lines, where Alco Diesels are pumping over 6 million barrels daily.

You can depend on ALCO DIESELS

Experienced pumping station superintendents say they want engines that stay awake . . . and can be depended upon for long periods of operation with minimum maintenance. That's why so many of them prefer Alco Standardized Diesels. For example, 37 Alco engines rolled up 814,752 hours with only .02% hours unscheduled shutdowns, in one typical installation.

Pumping station superintendents like Alco Economy, too.

- **Compactness means lower building costs.**
- **Higher engine efficiency means lower fuel costs.**
- **Flexible power range means easy expansion.**
- **Medium speed design cuts ⅓ the cost of principal auxiliary equipment.**

Investigate Alco Standardized Diesels today and find out why in the last 10 years *more of these engines have been installed in oil pipe line pumping service in the United States and Canada than any other make.* Contact your nearest American Locomotive Company Sales Office at Beaumont, Chicago, Cleveland, Houston, Kansas City, New York, San Francisco, Schenectady or St. Louis.

ALCO DIESELS

THE MARK OF MODERN ENGINEERING

AMERICAN LOCOMOTIVE COMPANY

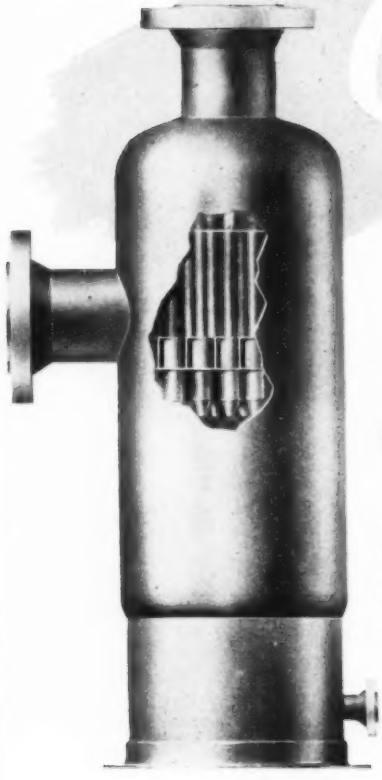
Clean

DRY GAS

in secondary distribution systems

with AEROTEC

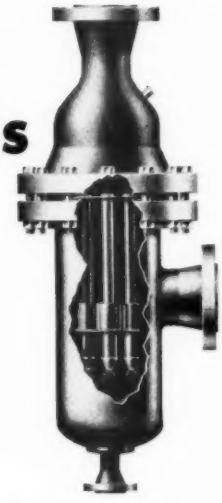
GAS SCRUBBERS



Multiple cyclone tubes of small diameter, assembled in the pressure shell, separate impurities from the gas with high efficiency.

LARGE VERTICAL TYPE

SMALL VERTICAL TYPE



Gas in your distribution lines stays clean and free-flowing with Aerotec Dry Gas Scrubbers on the job. These units apply the principle of centrifuging to remove entrained dusts, liquids, and distillates from the gas. It is a *dry* cleaning process. There is no oil or other filtering medium to carry over into the gas stream. Aerotec also eliminates other difficulties normally experienced with conventional types of scrubbers.

Simple in design and lightweight, Aerotec Dry Gas Scrubbers are available in sizes and capacities to meet all requirements of local distribution systems. Leading utilities such as Consolidated Edison Co., Manufacturers Light & Heat Co., Rochester Light & Heat Co., and many others use Aerotec units in scores of locations with outstanding results.

A Thermix Project Engineer is near you and will be glad to supply technical data and assistance in choosing Aerotec Dry Gas Scrubbers to fit your specific needs. Call or write.

Project Engineers **THE THERMIX CORPORATION** Greenwich, Conn.

(Offices in 28 Principal Cities)

Canadian Affiliates F. C. CHOWN, LTD., Montreal 25, Quebec; Toronto 3, Ontario

Manufacturers

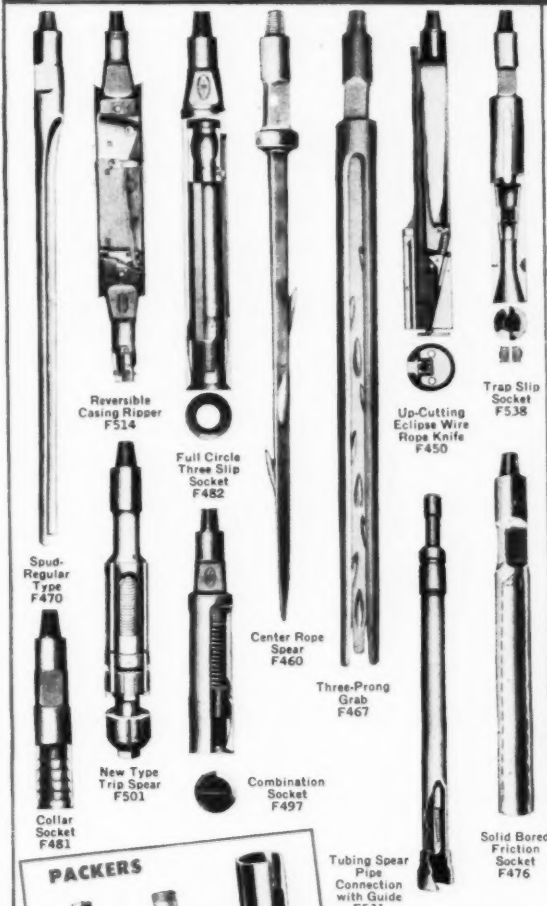
THE AEROTEC CORPORATION

GREENWICH, CONN.

FOR TODAY'S CABLE DRILLING and PACKING DEMANDS

CHOOSE SPANG TOOLS...

and Give Them Proper Care!


Spud-Regular Type F470
Reversible Casing Ripper F514
Full Circle Three Slip Socket F482
Center Rope Spear F460
Three-Prong Grab F467
Up-Cutting Eclipse Wire Rope Knife F450
Trap Slip Socket F538
Collar Socket F481
New Type Trip Spear F501
Combination Socket F497
Tubing Spear Pipe Connection with Guide F531
Solid Bored Friction Socket F476
FISHING TOOLS

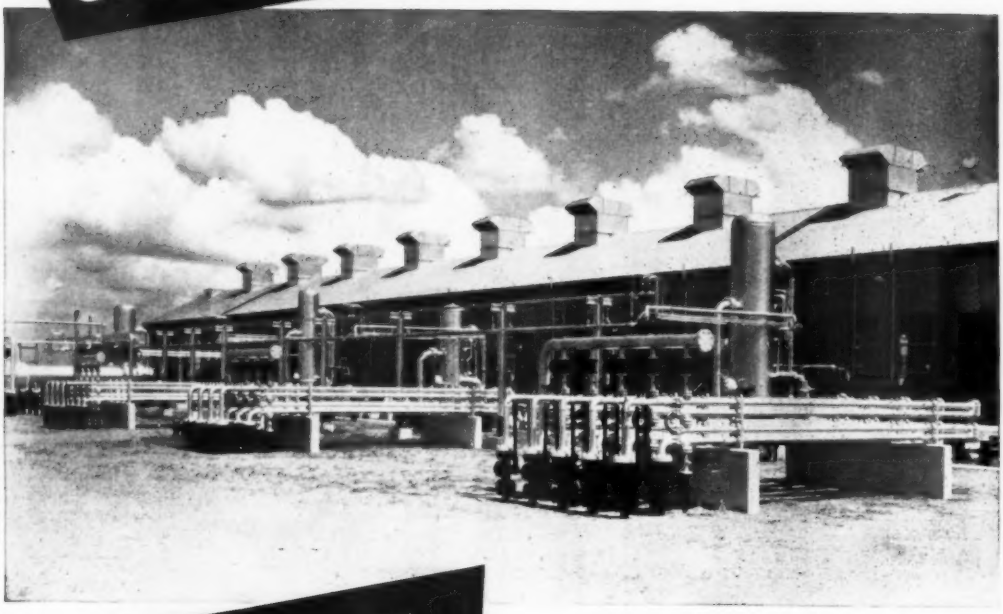
SPANG CABLE TOOLS and PACKERS

made by SPANG & CO., Butler, Pa.

For

OIL WELLS • GAS WELLS • ARTESIAN WELLS
SHOT BLAST HOLES • PROSPECT DRILLING

Reduce Obsolescence in your plant



with BROWN FINTUBE sectional hairpin heat exchangers

● Brown Fintube's interchangeability of parts, exacting design and precision manufacture has "licked" obsolescence.

The sections can be used in one bank after another — on different duties — and different products. A bank can even be broken up and the sections shipped to two or more plants, miles apart, re-assembled and reused. Sections not in use serve as "stores" for other sections on stream. They are never obsoleted by changes in duty or plant re-arrangements. You can use and reuse them until they are completely worn out. Estimates and quotations furnished promptly. ***Write for Bulletin No. 481.***

THE BROWN FINTUBE CO.

Elyria, Ohio

Sectional Hairpin Heat Exchangers
Tank Suction and Line Heaters
Fintube Heaters for Bulk Storage Tanks
Indirect Process Air Heaters
Fintube Heaters for Processing Tanks
Integral Welded Fintubes for Any Heating, Cooling or Heat Transfer Service

NEW YORK • BOSTON • PHILADELPHIA • WILMINGTON • PITTSBURGH • BUFFALO • CLEVELAND • CINCINNATI • DETROIT • CHICAGO
ST. PAUL • ST. LOUIS • MEMPHIS • BIRMINGHAM • NEW ORLEANS • TULSA • HOUSTON • LOS ANGELES • SAN FRANCISCO

Here is a magneto that controls explosive fumes with "flame-proof" ventilation. The special ventilating arrangement of the Bendix Low-Tension Magneto permits air laden with explosive fumes to enter the magneto for ventilation without danger of igniting the surrounding air. Kits are also available to convert magnetos now in use to the "flame-proof" ventilation type.

In addition to this important safety feature Bendix Low-Tension Magnetos actually reduce engine maintenance and operating costs. For example, spark plug erosion is reduced to a minimum. The distribution of low tension voltage to the high tension coils is through a series of breaker assemblies, thus eliminating trouble often experienced with the conventional distributor. Variable or fixed sparks can be obtained by internal adjustment.

For safety and low operating costs it will pay you to specify Bendix Low-Tension for all your magneto requirements. Complete data available on request.

- **Low Plug Erosion Rate**
- **Breaker Type Distributor**
- **Ventilation without Fire Hazard**
- **Radio Shielding Available**
- **Variable or Fixed Ignition**

Bendix

SCINTILLA MAGNETO DIVISION OF
SIDNEY, NEW YORK

Export Sales: Bendix International Division, 72 Fifth Avenue, New York 11, New York

Bendix AVIATION CORPORATION

FACTORY BRANCH OFFICES:
117 E. Providencia Avenue, Burbank, California • Stephenson Building, 6560 Cass Avenue, Detroit 2, Michigan
Brouwer Building, 176 W. Wisconsin Avenue, Milwaukee, Wisconsin • 582 Market Street, San Francisco 4, California

THERE ARE 5 POINTS *to this success story*

1. PRECISION GEARS—Precision generation by the famous Farrel-Sykes process, evenly distributed load, overlap or interlacing of the teeth, gradual engagement and inclined line of pressure keep power-transmission efficiency "fresh" through long years of service.

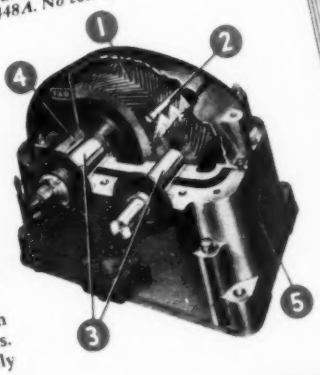
2. A "FOUNTAIN OF YOUTH"—The completely self-contained circulating oil system virtually puts power on "velvet" by providing a protective spray of oil at the mesh line of the gears and, at the same time, pressure-lubricating the bearings.

3. PRECISION-GROUND SHAFTS, extra large for the power to be transmitted, give added stiffness against bending and torsional deflections under peak loading variations.

4. OVERSIZE SLEEVE BEARINGS with consequent low unit pressures. Precision finished to extremely close tolerances.

5. EXCEPTIONALLY RIGID HOUSING holds rotating elements in original alignment, insuring maintenance of operating smoothness of the precision-generated gearing.

These five features account for the perfect record of Farrel speed increasers in pipeline pumping service. For further details, send for a copy of bulletin 448A. No cost or obligation.

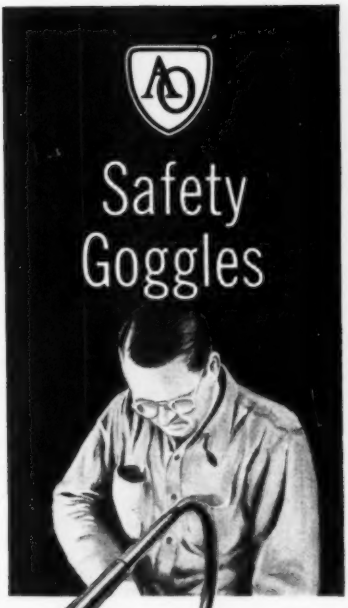


FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.
Plants: Ansonia and Derby, Conn., Buffalo, N. Y. • Sales Offices: Ansonia, Buffalo, New York, Boston, Pittsburgh, Akron, Detroit, Chicago, Portland (Oregon), Los Angeles, Salt Lake City, New Orleans

INT. FIELD REPRESENTATIVES
Hercules-Legfer Engine Sales Co., 324 N. Boston St., Tulsa 1, Okla.
V. W. Osborne, 840-A M&M Bldg., Houston 2, Texas

Farrel-Birmingham®

For Workers Who Need a **LIGHTWEIGHT, STRONG, DURABLE, GOOD LOOKING** Acetate Goggle...



the **AO F9200** is the Buy!

The AO F9200 Ful-Vue affords the highest quality eye protection against flying particles coming from the front, and is available with side shields when foreign objects endanger from the side. While used throughout industry in machine and hand tool work, chipping, grinding, riveting, bottling and welding with the recommended Calobar lenses, the goggle fills a particular need in chemical and electrical plants and other operations where sparks are fire and explosion hazards. Your nearest AO Safety Products Representative can supply you.

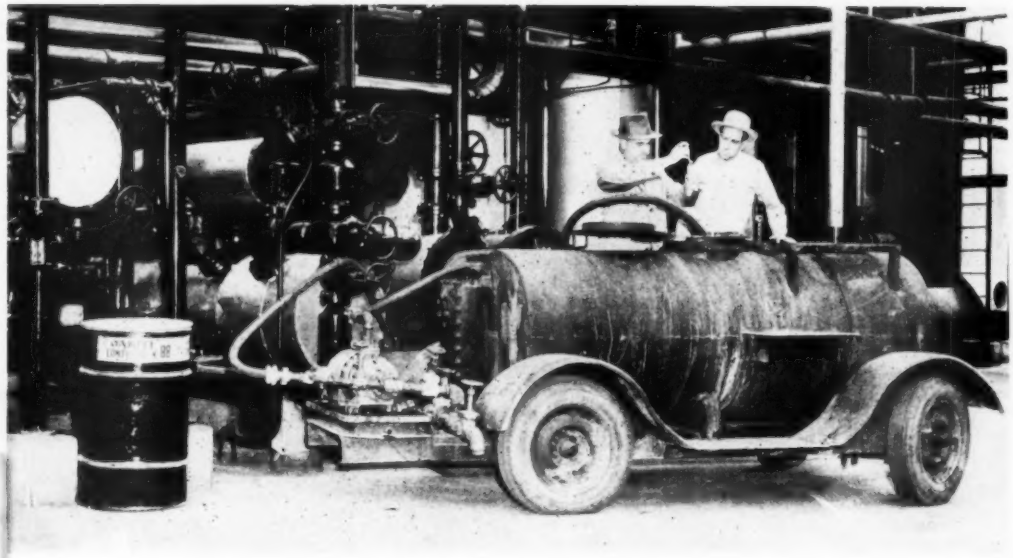
Remember whether the hazard is particles from the work, glare, heat, ultraviolet or infrared, cinders, dust or wind there is an AO Goggle that meets the need.

QUICK FACTS

- Hinges and temples out of line of sight, for unobstructed side vision.
- Face formed keyhole bridge for extra protection and comfort.
- Lenses conform to and cover eye orbit for safety, better vision, appearance.
- Nose pads designed to hold goggle firmly and comfortably. FOR ADJUSTABLE PADS FOR HARD-TO-FIT WORKERS ASK FOR NEW AO FX9200 goggle.
- Available with comfort cable or skull temples. Former have metal core; are enclosed and sealed. Skull temples have extra strong wire core encased in acetate.
- Side shields are perforated acetate to help keep lenses fog-free.
- 6 curve super armorplate clear or Calobar lenses in medium, dark or extra dark shades . . . ground to the worker's own prescription if desired.

American Optical COMPANY
SAFETY PRODUCTS DIVISION

SOUTHBRIDGE, MASSACHUSETTS • BRANCHES IN PRINCIPAL CITIES



Refinery's own crew cleans heat exchangers in place

No outside help needed to do *this* job. This refinery saves money, time, tubes by cleaning and descaling heat exchangers the simple Oakite way.

Here's how: First circulate a solution of recommended Oakite cleaner through oil side to remove carbon, wax, oil deposits. Then circulate Oakite Compound No. 32 through water side to remove scale and rust. Method quickly restores unit to peak heat transfer efficiency. No expensive dismantling. No tedious steam lancing.

Your Oakite Petroleum Service Representative will gladly help you set up your own heat exchanger cleaning system. Call him today. Or write Oakite Products, Inc., 50D Thames St., New York 6, N. Y. for *free* booklet.

FREE BOOKLET F7629 gives full details on cleaning heat exchangers; cleaning towers; reconditioning drums; cleaning tank cars; reconditioning salvage parts. Get your copy today!

SPECIALIZED INDUSTRIAL CLEANING

OAKITE

MATERIALS • METHODS • SERVICE

petroleum service division

AMERICAN METER COMPANY'S

New Dallas Plant

New Convenience for the Southwest Area

You are cordially invited to visit our new plant and showroom at 1300 Industrial Boulevard, Dallas. Designed to specialize in the production of Orifice Meters and related equipment, it speeds deliveries and makes possible a personalized, sales-engineering service including consultations on instrument problems.

The new showrooms afford complete facilities for conducting Instrument Schools for engineers and maintenance men. The complete line of American Meter Company products will also be on permanent display.

AMERICAN METER COMPANY
INCORPORATED (ESTABLISHED 1836)

GENERAL SALES OFFICE: 1513 Race St., Philadelphia
Albany • Alhambra • Amarillo • Atlanta • Baltimore
Birmingham • Boston • Chicago • Dallas • Denver
Erie • Houston • Kansas City • Los Angeles • New York • Odessa • Pittsburgh • San Francisco • Tulsa
Canadian Meter Co., Ltd., Hamilton, Ontario

prevents wear on seats of

CHAPMAN

Tilting-Disc CHECK VALVES

Here's the check valve with the balanced disc which is cushioned to a quick and quiet closure by the flow of gases or fluids as you can see in the cross-section at the right.

This smooth action prevents undue wear on seats, hinge pins and bearings . . . *and on your maintenance budget!* For there's no loosening of lines by vibration, no opened joints or ruptured pipes.

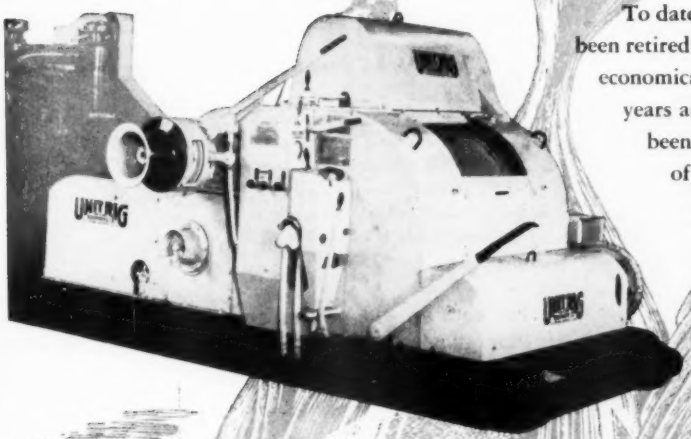
What's more, head losses are 65% to 80% less than conventional swing-type checks. Available in iron or steel in all standard pipe sizes. Get the complete story on this and other cost-cutting features of Chapman Tilting-Disc Check Valves, in the latest bulletin, No. 30. Send for your copy now.

THE CHAPMAN VALVE MFG. CO.
INDIAN ORCHARD, MASSACHUSETTS

Cross-section of the Chapman Tilting-Disc Check Valve illustrating the way that the balanced disc is supported on the pivot, with arrows showing the travel of the disc. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.

HOW LONG SHOULD A DRAWWORKS LAST?

How long a drawworks should last, depends, of course, upon how much it is used, and what kind of care it has had. For fifteen years Unit Rig has kept track of the Unit Rig drawworks sold. The record of performance and long life of these units gives some idea how long a Unit Rig drawworks will last under average conditions.



To date only ONE Unit Rig model has been retired because it was worn out beyond economical repair. This is after fifteen years and after hundreds of units have been put into operation. This record of performance proves why Unit Rig users reorder Unit Rig equipment time and again.

Make your next drawworks a ***UNIT RIG.***

UNIT RIG & EQUIPMENT CO.
TULSA, OKLAHOMA U.S.A.

DESIGNED FOR THE JOB . . .

UR-511

UNIT RIG DRAWWORKS ARE SOLD EXCLUSIVELY THROUGH THESE AUTHORIZED DISTRIBUTORS IN THE U. S. A. AND CANADA

BOYAIRD SUPPLY COMPANY
HOUSTON OIL FIELD MATERIAL COMPANY
HOWARD SUPPLY COMPANY
IVERSON SUPPLY COMPANY
JONES & LAUGHLIN SUPPLY COMPANY
LUCEY PRODUCTS CORPORATION
MID-CONTINENT SUPPLY COMPANY
NORVELL-WILDER SUPPLY COMPANY
OIL WELL SUPPLY COMPANY

EXPORT SALES — MID-CONTINENT SUPPLY COMPANY, 42 Broadway, New York City. Cable — MIDUNITRIG

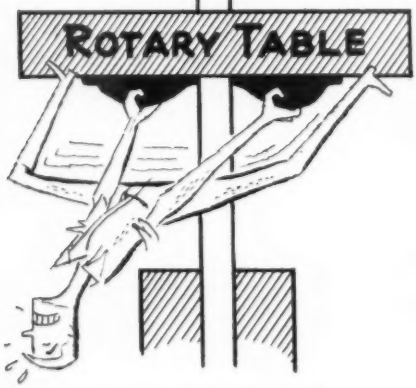
ONLY WEATHERFORD

ILL PIPE
IPER

ent No. 2,392,146
(Oth U. S. and Foreign Patents
applied for)

THE EXCLUSIVE SAUCER SHAPE

OF THE WEATHERFORD DRILL PIPE WIPER



1. Keeps it from being pulled up into the rotary table . . . thus protected, it is afforded maximum wear. (Flat wipers are pulled into the table and destroyed against the rotary table bushings by the drill pipe).

2. Acts as a "catcher" for tong dies, while wiping the pipe. Diverts wash water off the rotary table from the mud and retains a small amount of the water which acts as a lubricant for the rubber. Helps operator to save expensive mud.

The cartoon above illustrates the exclusive advantage of the Weatherford Drill Pipe Wiper. The saucer shape construction keeps it from being destroyed against the rotary table bushings. It is the only known wiper to give such long-wearing service.

For coming out of the hole, the Weatherford Drill Pipe Wiper is UNCONDITIONALLY GUARANTEED

Drill Pipe Wipers are sometimes used going into the hole and, when so used, the drill pipe carries the wiper away from the table to the head of the well. Due to the fact that well heads are of so many different sizes and shapes, the wiper is not always adapted for this use.

Caution should be exercised when employing the wiper in this fashion. A suggested method is to reverse the wiper or place an old wiper reversed beneath the new one, but in neither event does the usual guarantee stand in this type of operation.

The Weatherford Wiper is a combination of hard and soft rubber . . . no metal to cause sparks.

Give drill pipe and rotary table size when ordering.

Sold through Supply Stores

WEATHERFORD

SALES OFFICES:

	PHONE				
Bakersfield, Calif.	4-4334	Great Bend, Kan.	4341 or 7276	Laurel, Miss.	3378
Ventura, Calif.	Miller-3-4898	Harvey, La.	Uptown 3981	Mobbs, N. M.	166 or 307
Long Beach, Calif.	623-114	New Iberia, La.	1646	Farmington, N. M.	283-J
		Shreveport, La.	5-8624	Okla. City, Okla.	42-3904

..offers you these features!

U. S. and Foreign Patents pending and issued.

Weatherford Drill Pipe Protectors are supplied in all fields and installed quickly with the Weatherford Applicator.

WELL CONDITIONS ENCOUNTERED BY DRILL PIPE PROTECTORS

1. Rough treatment coming out of and going into the hole.
2. Drilling abrasives of various sizes passing the outer diameter of the protector.
3. Wide range of temperature (from pipe rack to the bottom of the hole).
4. Oil and gases under a wide range of pressures.

HOW WEATHERFORD PROTECTORS OVERCOME THESE CONDITIONS

The following features are found in Weatherford Protectors only:

1. Larger inner diameter at the ends, tapering to a smaller diameter at the center. When installed, the ends of the protector will not be stretched as tightly as the center and the likelihood of tearing is greatly reduced. (Protectors lacking this feature are easily torn).

2. As the smallest inside diameter of the protector is at the center, the rubber stretched to the greatest degree is shielded from bruising by its tapered ends. This affords maximum gripping power at the middle section which expells and prevents ingress of fluids between the protector and drill pipe. Thus lubrication, which is one of the major causes of slipping on the pipe, is eliminated.

3. The inner wall of the protector, which grips the drill pipe, is perfectly smooth. Tests have proved that a smooth rubber surface against a smooth metal surface gives the best adhesion and gripping qualities.

4. The stepped and tapered design breaks the turbulence of the passing mud flow, thus protecting the pipe and protector from abrasion.

ADDITIONAL ADVANTAGES OF WEATHERFORD OIL-RESISTANT PROTECTORS

1. Natural rubber is used for the core of this protector, affording better gripping qualities and resilient durability over a larger range of temperatures.

2. Since natural rubber does not provide adequate resistance to the deteriorating effect of oil and gas a resistant cover of a different character is essential. Synthetic rubber is therefore used for the outer shell or cover, since it does resist the effects of oil and gas.

For the above reasons the Weatherford Protector, with the oil and gas resisting synthetic rubber cover, meets the deteriorating conditions encountered in oil wells more satisfactorily than does any other protector.

Therefore, we guarantee all Weatherford Oil and Gas Resistant Protectors against slipping on the pipe, the effects of extreme temperature, and the absorption of oil and gas.

We also guarantee our natural rubber protectors against slipping on the pipe and the effects of extreme temperatures, but NOT *against absorption of oil and gas.*

Sold through Supply Stores

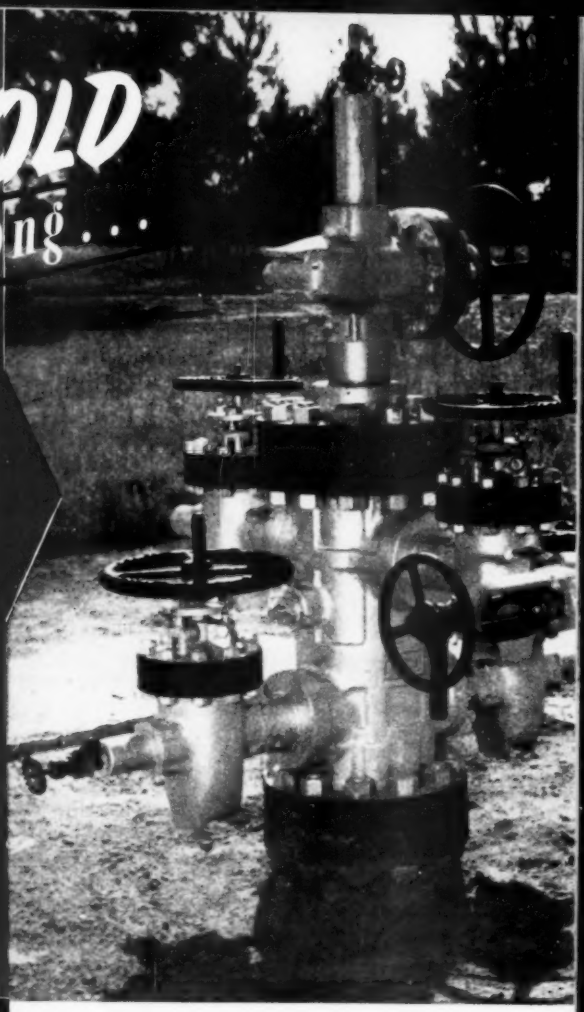
OIL TOOL CO., Inc.

Abilene, Texas 3-4128
Beaumont, Tex. 4-3242 or 4-8221
Corpus Christi, Texas . . 4-8260
Houston, Texas . Wonderest 7411
Longview, Texas 2291
McAllen, Texas . 2014-W or 280
Nacogdoches, Texas 486
Odessa, Texas 4-3073
Sayner, Texas 1226
Victoria, Texas 3264
Weatherford, Texas . LD 1 or 257
Casper, Wyoming 4330

15 YEARS OLD

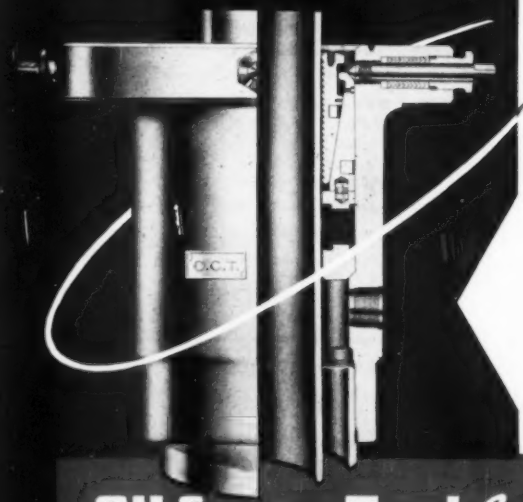
and still going strong...

NOT A SINGLE PIECE OF ORIGINAL EQUIPMENT HAS BEEN CHANGED OR REPAIRED ON THIS O-C-T ASSEMBLY



According to the record, this O-C-T 6000 lbs. test assembly was applied up on October 1, 1938. Tubing pressure at that time was 2900 lbs. Since then, the operator has had absolutely no maintenance or expense on the tree. The service given by this O-C-T Christmas tree is typical of that given by thousands of other O-C-T well head assemblies throughout the oilfields of the world.

Talk to your O-C-T representative about your well head assembly requirements. O-C-T products are always dependable and available through more than 700 conveniently located supply stores.



...and this is the head of the future

This is the O-C-T "C-19" Casing Head, the only casing head that meets every well completion condition with a single compact model.

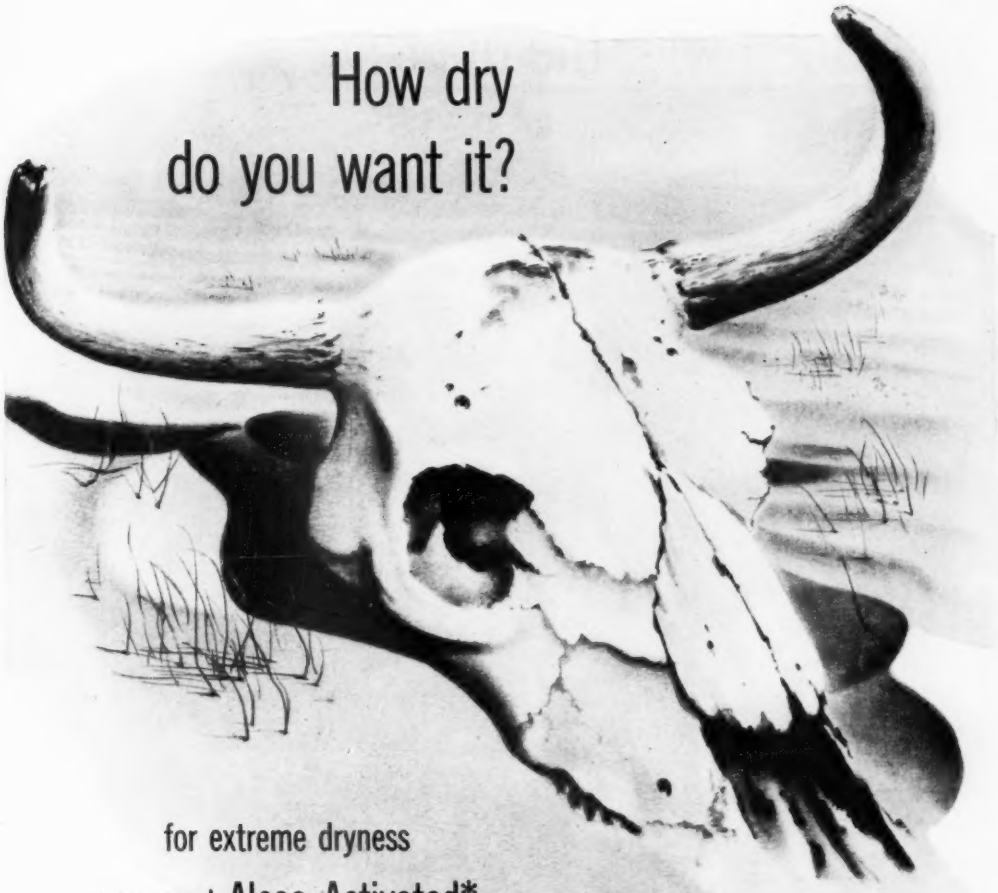
Every man on the drilling-production team has good reasons for liking the O-C-T "C-19" casing head. When dropped through preventers, suspension and seal are automatic. Thus, the "C-19" casing head eliminates open hole hazards. In addition, load capacity is twice as great as conventional slip hangers . . . slips set evenly and bite evenly . . . no field welding is required . . . hazardous installation work in muddy and cramped cellar space is reduced to a minimum and hours of valuable rig time are saved. Yes, it's true no other casing head gives you O-C-T flexibility and safety. Ask your O-C-T Representative for details.

Oil Center Tool Co.

P. O. BOX 3091 - HOUSTON, TEXAS

Export Representatives: Sterling Areas—Le Grand, Sutcliff & Gell, Ltd., Southall, Middlesex, England. Address Export Inquiries for All Other Countries to P. O. Box 3091, Houston 1, Texas

How dry do you want it?



for extreme dryness you need Alcoa Activated* Alumina

Every day more and more petroleum companies are discovering the efficiency and economy of ALCOA *Activated* Alumina for the dehydration of liquids, vapors and gases. They know that it's one of the most effective desiccants they can buy. Dew points as low as *minus 100° F.*—and even lower—can be obtained, and ALCOA *Activated* Alumina can be used for an almost indefinite number of drying cycles.

ALCOA *Activated* Alumina has high resistance to crushing, shock and abrasion . . . will not soften, swell or disintegrate even when immersed in water . . . is non-toxic . . . non-corrosive . . . high in purity . . . practically iron-free.

ALCOA *Activated* Alumina is used to adsorb certain gases and vapors from gaseous mixtures, and serves as a catalyst and catalyst carrier.

What do you dry? How dry do you want it? Whatever your answer, it will pay you to investigate ALCOA *Activated* Alumina. We will gladly send you complete information. Write to: ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION, 618M Gulf Building, Pittsburgh 19, Pennsylvania.

**Reg. T.M., Aluminum Co. of America*

FREE—A large color print of this illustration on heavy stock, without advertising matter, suitable for framing. Write us.

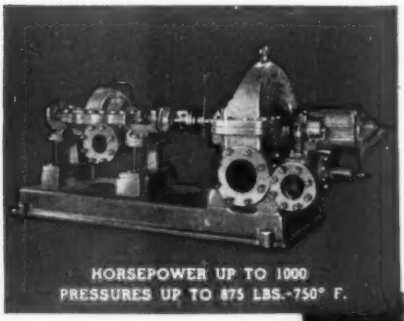
Alcoa Chemicals

ALCOA

ALUMINAS and FLUORIDES

ACTIVATED ALUMINAS • CALCINED ALUMINAS • HYDRATED ALUMINAS • TABULAR ALUMINAS • LOW SODA ALUMINAS ALUMINUM FLUORIDE • SODIUM FLUORIDE • SODIUM ACID FLUORIDE • FLUOBORIC ACID • CRYOLITE • GALLIUM

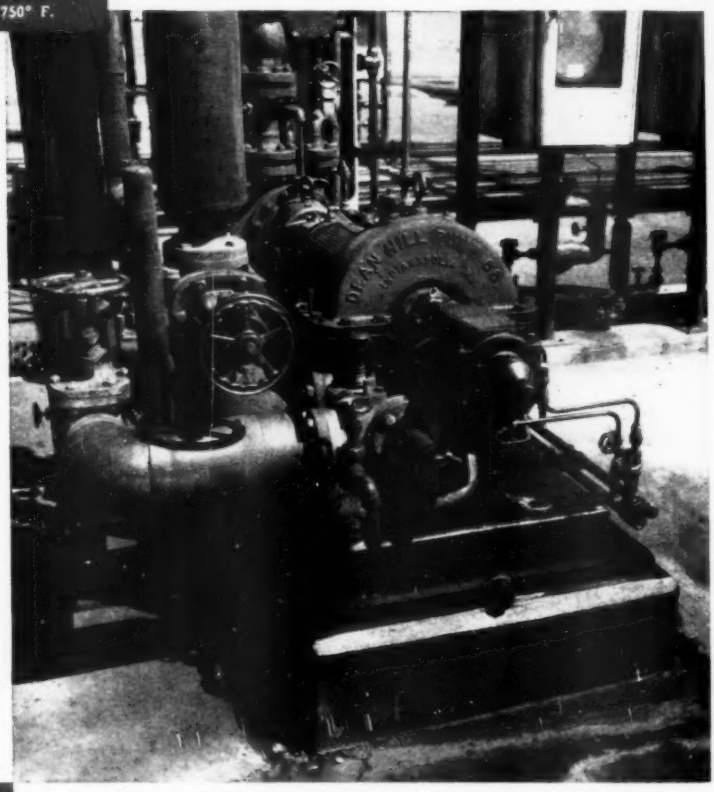
Designed with the operator in mind!



No streamline housings.
No needless cover-ups.
Nothing fancy or frilly about these power-making huskies. Dean Hill Steam Turbines are designed and built for nothing but long service and easy, economical operation. Their heavy, rugged construction is simple and uncluttered for quick, easy maintenance. All pressure parts are outside and visible to operator.

DEAN HILL STEAM TURBINES

.....are single stage, double impact type for low steam consumption. Specifically designed for operation at medium steam pressures and temperatures, DH Turbines have all the advantages available under these conditions, including excellent water rates. Write us for further information and complete specifications.



One of eighty-four Dean Hill Steam Turbines recently installed in a large, eastern Refinery

DEAN HILL PUMP COMPANY
Pump and Turbine Engineers Since 1895
INDIANAPOLIS 7, INDIANA

SALES OFFICES IN:
Chicago • Mexico City • Philadelphia • Salt Lake City • New York • Dallas • New Orleans • San Francisco • Denver • Los Angeles • Pittsburgh • Houston • St. Paul • Cleveland

Industry's most Versatile Rig!

Unique design of double pump drives is shown in this view of GB-800 with belt and clutch guards removed.

Choice of Two Installations

One-package, flat-set: Drawworks, engines and compounding transmission are mounted on a common skid. Entire unit cradles in substructure.

Two-package, single-step: Drawworks and compounding transmission are mounted at separate levels. In this arrangement, only the in-put drive has to be disconnected in moving the rig.

FIRST to Provide "In-Line" and "Individually-Driven" Pump Drives

Designed for portability, low-cost maintenance and reduction of hole-to-hole downtime, the new Esmco GB-800 offers features not heretofore available in a rig of its size. Here are some of the *firsts* to its credit:

FIRST rig of its size to be designed primarily for portable derrick operation.

FIRST rig to be equipped with in-line, individually-driven pump drives. Location of the drives at back of compounding transmission eliminates notching of the substructure and use of belt idlers, and greatly simplifies pump manifolding. Pumps may be driven simultaneously at different speeds.

FIRST rig designed with either dumping-type fluid couplings or mechanical couplings mounted directly on compounding transmission shafts.

FIRST rig of its size to provide complete forced-feed lubrication, eliminating downtime for greasing.

FIRST rig to have all operating clutches located on the outboard ends of shafts for easier servicing.

FIRST flat set rig of its power class to eliminate the need for breaking chains, oil lines or air lines when being transported.

For information regarding the outstanding performance record of the new GB-800 rigs call CONTINENTAL.

EMSCO DERRICK & EQUIPMENT COMPANY

Houston, Texas • LOS ANGELES, CALIFORNIA • Garland, Texas

CONTINENTAL

"SERVING THE OIL AND GAS INDUSTRIES"

THE CONTINENTAL SUPPLY COMPANY, General Offices: DALLAS, TEXAS

Export Div.: The Continental Supply Co., Inc., 30 Rockefeller Plaza, New York, N.Y.
The Continental Supply Company, Limited, 216 Lancaster Bldg., Calgary, Alberta

Representatives: Argentina, Bolivia, Brazil, Chile, Colombia, England, Ecuador, Peru, Trinidad, Uruguay, Venezuela

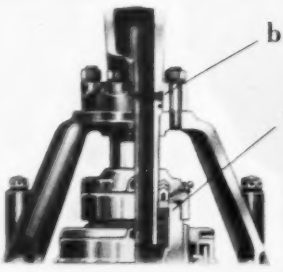
EMSCO D+B

EMSCO

REG. U.S. PAT. OFF.

H 107-F—1951

Washpipe and Packing Life Quadrupled in Emsco Swivels



This cutaway view, right, shows (a) cartridge washpipe packing installed; (b) Emsco's exclusive washpipe gooseneck sealing ring that prevents mud leakage and provides for easier installation and automatic alignment of the washpipe.

Emsco's patented, one-piece cartridge washpipe packing represents the greatest single improvement in swivels. It *quadruples* the life of packing and washpipe . . . reduces maintenance expense and rig downtime.

Actually, the Emsco cartridge washpipe packing is four packings in one. Each of the four lip-type sealing rings, built into the cartridge, has the same wear-life as conventional packing. Only one of the soft, flexible sealing rings is in contact with the washpipe at a time. As each lip wears, the sealing function passes on to the next higher lip.

The Emsco cartridge washpipe packing fits only one way! No adjustment is required after it is installed.

Another exclusive feature of Emsco swivels is the washpipe gooseneck sealing arrangement. This assures fast, easy installation and automatic alignment of the washpipe.

In addition, Emsco swivels are designed with high bearing load capacity and incorporate field-proven features pioneered by Emsco. The dead load capacity of Emsco swivels ranges from 125 to 450 tons. Call CONTINENTAL for detailed information.

EMSCO DERRICK & EQUIPMENT COMPANY

Houston, Texas · LOS ANGELES, CALIFORNIA · Garland, Texas

EMSCO D+B

EMSCO

H 107-B — 1951

CONTINENTAL

"SERVING THE OIL AND GAS INDUSTRIES"

THE CONTINENTAL SUPPLY COMPANY, General Offices: DALLAS, TEXAS

Export Div.: The Continental Supply Co., Inc., 30 Rockefeller Plaza, New York, N.Y.
The Continental Supply Company, Limited, 216 Lancaster Bldg., Calgary, Alberta

Representatives: Argentina, Bolivia, Brazil, Chile, Colombia, England, Ecuador, Peru, Trinidad, Uruguay, Venezuela

Three kinds of towers
In this composite picture the refinery tower and the treater tower are of direct interest to oil men. They are examples of productions available from Canada's oldest and largest steel fabricators.
We added the photograph of the suspension bridge towers* to remind you that for almost any type of steelwork in refinery and field operations the name to remember is
DOMINION BRIDGE.
Left: FRACTIONATOR TOWER at the Montreal East Refinery of the British American Oil Co. Ltd.
Right: TREATER UNIT, manufactured by our associated Company, the Standard Iron & Engineering Works Ltd., Edmonton, under licence for the National Tank Co. Tulsa, Okla.
*Lion's Gate Bridge, Vancouver, also fabricated and erected by Dominion Bridge.
DOMINION BRIDGE COMPANY LIMITED
Divisions: STRUCTURAL, PLATEWORK, BOILER, MECHANICAL, WAREHOUSE
Plants at: VANCOUVER • CALGARY • WINNIPEG TORONTO • OTTAWA • MONTREAL
Assoc. Companies at: EDMONTON • SAULT STE. MARIE • QUEBEC • AMHERST

It begins where other gauges leave off-

The now recognized ability of the Marsh Mastergauge to do a better job for more years is a direct result of setting out to design and build an instrument possessing accuracy, precision, and stamina beyond any gauge that had ever been produced.

Try the Mastergauge where other gauges have failed — under the gruelling conditions of extreme temperature, heavy pulsation, racking vibration — conditions that wreck the ordinary kind. You will find that it truly begins where others leave off.

We can say this today without fear of contradiction because Mastergauge has *said it for itself* . . . in thousands of applications throughout the oil country.

And remember: The toughest gauge to knock *out* of adjustment is the easiest gauge to get back *in* adjustment . . . thanks to the exclusive "Marsh Recalibrator."

Ask your supply store, or write us, for Marsh Oil Industry Bulletin.

MARSH INSTRUMENT COMPANY
Sales affiliate of Jos. P. Marsh Corporation

Dept. L, Skokie, Ill.

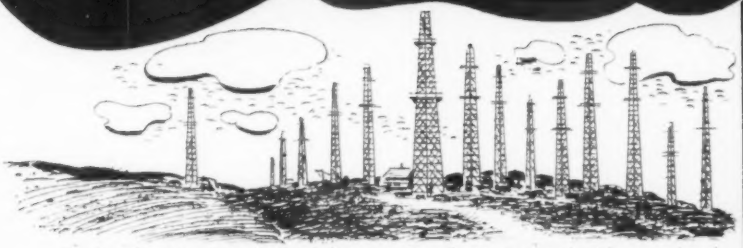
The Marsh branch plant at Houston offers shipment from stock and advanced facilities for repairing all makes of gauges.

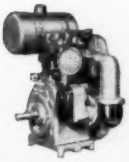
MARSH MASTERGAUGE —

Marsh Mastergauge, guaranteed accurate within 1/2 of 1% of reading—a precision gauge for a precision industry. The Mastergauge line also includes gauges especially designed for blenders, boilers, burners, capping, Christmas-trees, columns, heaters, hydrogen units, instrument panels, pumps, Reid vapor bombs, scrubbers, separators, mud pumps, stills, towers and other applications. A typical installation is this even dozen of Mastergauges in distillate fields, Cranfield, Miss.

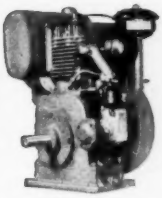
Performance-Proved Field-Tested POWER...

WISCONSIN HEAVY-DUTY Air-Cooled ENGINES

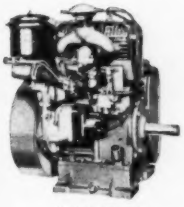




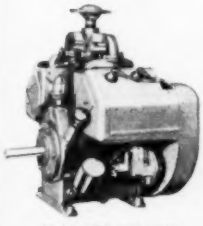
Models ABN, AKN, AEN
4-cycle
Single Cylinder
3 to 7½ hp.



Models AFH, AGH, AHH
4-cycle
Single Cylinder
6 to 9 hp.



Models TE, TF
2-cylinder
7 to 13 hp.



Models VE4, VF4, VP4D
V-type, 4-cylinder
15 to 31 hp.

The fact that Wisconsin Air-Cooled Engines have been given such wide-spread and enthusiastic acceptance in the Oil Field is due to several good, solid factors:

1 Field-Tested. Wisconsin-powered equipment is being tested constantly under actual operating conditions by the field staff of Harley Sales Company. Accurate service records determine the advantages and limitations of the units on test, thereby providing the customer with ultraconservative performance claims. The customer knows, in advance of purchase, what to expect . . . and usually his best expectations are more than fulfilled.

2 Performance-Proved. Thousands of Wisconsin Heavy-Duty Air-Cooled Engines, ranging from the power-packed little ABN and AKN models (3 to 6 hp.) to the husky VP4D V-type, 4-cylinder job, turning up 31 hp. at 2200 R.P.M., are delivering hard-hitting, dependable power every day, under all conceivable operating conditions. "Most H.P. Hours" of performance-proved service provides tangible evidence of Wisconsin Engine stamina and economy.

3 Sellers' Service. As primary oil field distributors, the Harley Sales Company has full recognition of the need for prompt delivery of equipment and parts and maintains exceptionally large warehouse stocks. Orders for parts are handled the same day they are received.

4 Manufacturer's Responsibility. As the world's largest builders of heavy-duty air-cooled engines, the Wisconsin Motor Corporation has a responsibility both to the *seller* and *user* that is fully met and sustained to the limit of our ability.

All this adds up to the kind of a deal that pays off for the power user in terms that are most satisfactory to him.

WISCONSIN MOTOR
Corporation
MILWAUKEE 46, WISCONSIN
World's Largest Builders of Heavy-Duty Air-Cooled Engines

WRITE TO HARLEY SALES CO.
619 S. MAIN STREET, TULSA, OKLAHOMA
M & M BUILDING, HOUSTON, TEXAS
505 SOUTH MAIN ST., WICHITA, KANSAS
OIL FIELD DISTRIBUTORS FOR WISCONSIN ENGINES AND ALL TYPES OF UTILITY UNITS.

electric brakes withstand all kinds of weather and road conditions . . . give you precision synchronization

SAFE STRAIGHT-LINE BRAKING

Ask the men in the oil fields who use Warner Brakes on their trailers just what they think of *electric* braking. They'll tell you that through muck, mud and mire . . . over rough roads . . . during every kind of weather . . . Warner *Electric* Brakes give day-in, day-out *trouble-free, safe* braking.

That's because Warner *Electric* Brakes are a "natural" for oil field operations. No other braking system equals Warner's for simplicity. There's *full clearance* under tractor and trailer . . . nothing exposed to get knocked off or leak . . . just simple wiring to each wheel. There's a minimum of parts to check and service.

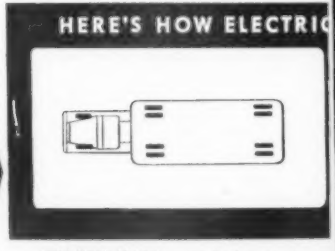
And with Warner *Electric* Brakes you get *precision synchronization* . . . instantaneous, *uniform* braking of all wheels on both the tractor and trailer No time-lag in the action . . . braking power is applied *instantly* with the speed of electricity!

This means smooth, *straight-line* deceleration and stops . . . gives you the ideal braking system for exceptional safety, outstanding dependability.

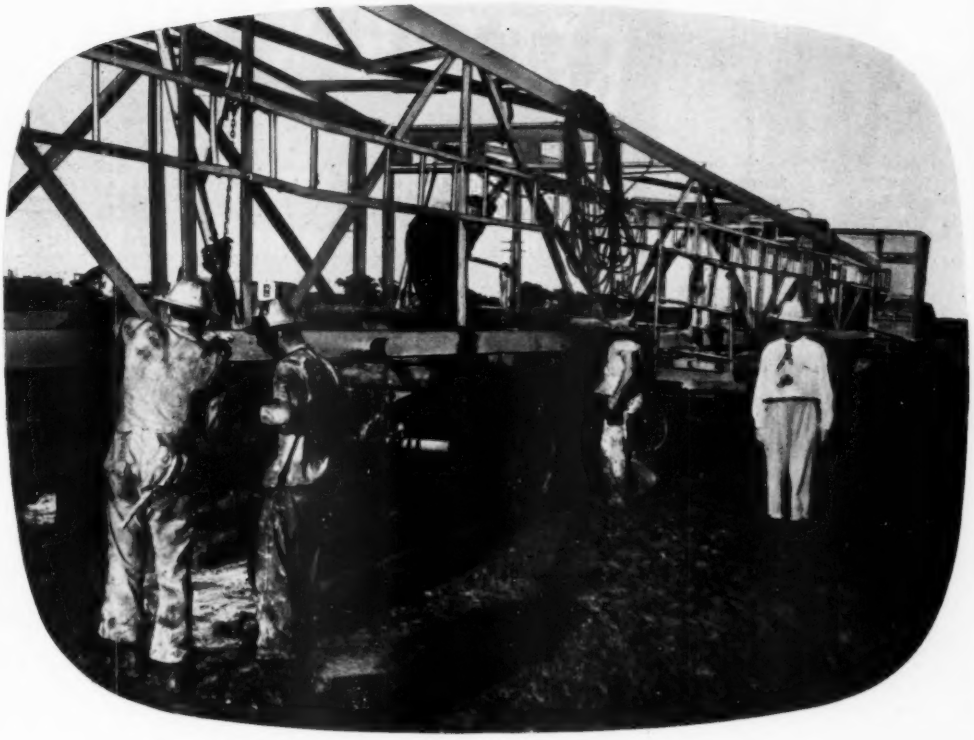
WARNER ELECTRIC BRAKE & CLUTCH COMPANY, BELOIT, WISCONSIN, U. S. A.

ELECTRIC BRAKES

FOR TRUCK TRAILERS



"WARNER WAY" . . . all brakes reach full power together to keep tractor and trailer in line . . . whether for gradual or fast emergency stops. Here's safe, straight-line braking.



Since 1933, Warner Electric Brakes have been more than proving their worth under tough oil field conditions . . . on floats and pipe trailers of Heldt Bros., Alice, Texas

Here's what Heldt Bros. have to say about their experience with Warner Electric Brakes:

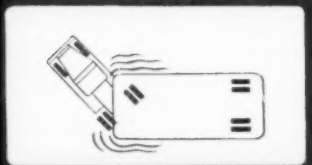
"We have been users of Warner Electric Brakes since 1933. Our fleet consists of 80 self loading floats and pipe trailers.

"This photograph shows the conditions under which our equipment operates and the type of treatment Warner Electric Brakes are subjected to.

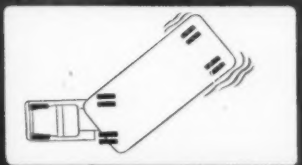
"We are proud that our fleet won the National Safety Contest for the past two years. We know too, that you will be proud of this record and performance of Warner Electric Brakes."

If you are not already taking advantage of the extra safety and extra dependability provided by Warner *Electric* Brakes, investigate now. Send for free folder shown below.

RAKES PROTECT AGAINST JACK-KNIFING



WRONG WAY . . . here's what can happen when brakes aren't synchronized and tractor brakes "come in" ahead. Jack-knife is sudden, drive wheels slide sharply. Recovery is difficult.



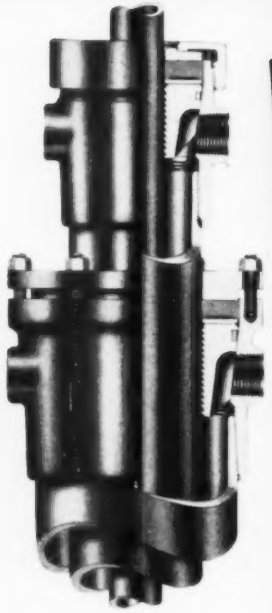
WRONG WAY . . . the other type of trouble that can result when brakes are not synchronized. Trailer brakes "build up" first . . . rear of trailer swings, then comes around into a jack-knife.

FREE! **New factual folder "Six Steps to Better Braking for Truck Trailers." Get your copy now.**

Gives important tips on driver safety through synchronized braking. Explains the precise operation, simplicity of hook-up, amazing economy and added safety features of *electric* braking. Write today. Warner Electric Brake & Clutch Company, Dept. OGJ, Beloit, Wisconsin.

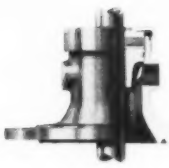
RECTOR REDHEAD

gives you widest variety of low-pressure casing and tubing head arrangements.

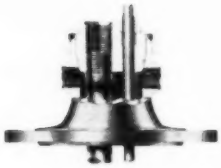


Type R Forged Steel Casing and Tubing Heads

● Threaded bottom Type R Tubing Head with slips and stripper. For workover jobs a second stripper can be used in place of the slips in the adapter bowl. Slips and stripper are interchangeable in head and bowl.



● The Type R Tubing Head with light flange for use on low pressure well having a flanged casing head . . . or to replace high pressure tubing head and tree when changing from flowing to pumping conditions.



● The original tubing head installation can be adapted to the Kobe Pump simply by using the special threaded mandrel with stuffing box for the power lines. The mandrel, resting on a ground joint seat, has an "O" ring seal.

● Type "R" Casing Head with threaded bottom. Notice how ribbed construction of slips permits full flow to side outlets, also simplicity and effectiveness of sealing arrangement.

RECTOR WELL EQUIPMENT COMPANY INC

★ MAKING THE OIL INDUSTRY SAFER ★

1100 NORTH COMMERCE ST. FORT WORTH, TEXAS

Houston Plant: 2215 Commerce St.

REPRESENTATIVES IN ALL ACTIVE FIELDS

RECTORHEAD RECTOR COLBORE CEMENTING METHOD RECTORSEAL

ASSOCIATION OF WELL HEAD Equipment MANUFACTURERS CERTIFIED

Igloo or Jet Engine...

Wherever temperatures are important to you, there's a dependable American Thermometer or Temperature Measuring Instrument for the purpose. The line is so complete, selection for specific needs is easy, whether you require accurate temperature measuring instruments to safeguard product quality, protect equipment or control costs.

American Thermometers and Temperature Indicators and Recorders are available in ranges from minus 100°F. to plus 3000°F., with *actuation by mercury, vapor pressure, gas, bi-metal or thermocouple* —depending on instrument type and requirements. And, to indicate or record temperatures accurately as far as 250 feet from the temperature source, famous "Magic Pulse" self-compensating capillary tubing can be supplied.

Whether you must know the exact temperature of a kiln, processing vat, deep freeze – anything hot or cold – choose from the many fine American Thermometers and Temperature Measuring Instruments. New catalog gives complete details.

Stocked and Sold By Leading Distributors

AMERICAN RECORDING THERMOMETERS

Single, double, or triple pens in round or rectangular cases. 10-inch chart with effective scale width of 3⅝" for easy, accurate reading. Chart Drive: 24-hour spring wound or electric. Actuation: mercury, vapor pressure, or gas. Ranges from minus 60°F. to plus 1000°F.

AMERICAN ELECTRONIC TEMPERATURE INDICATORS

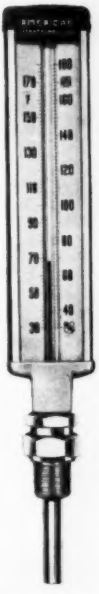
A radically new pyrometric-type instrument. Combines the unique Microsen Balance with the sensitivity of thermocouple measurement. Extremely accurate, rugged, dependable. Power actuated pointer. Ranges from minus 100°F. to plus 3000°F. American Electronic Temperature Recorder also available.

AMERICAN DIAL THERMOMETERS

Clear, bold figures on exactly graduated dials; pointer of contrasting color. Actuation: mercury, vapor pressure, gas, or bi-metal. Ranges from minus 60°F. to plus 1000°F. Cases for stem, wall, or flush mounting.

AMERICAN INDUSTRIAL GLASS THERMOMETERS

Full scale opening of 7", 9", or 12" with easy-to-read red mercury tubing. Ranges from minus 80°F. to plus 1150°F. Straight and angle forms.



1850 AMERICAN U.S.A.

AMERICAN INDUSTRIAL INSTRUMENTS

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONNECTICUT

MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'HANCOCK' VALVES, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY AND RELIEF VALVES. BUILDERS OF "SHAW-BOX" CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES.

Here's a Record that's Hard to Beat—

PICKRELL DRILLING COMPANY, INC.
Drilling Contractors • Oil Producers
FOURTH NATIONAL BANK BLDG.
WICHITA 2, KANSAS

September 20, 1951

Diesel Equipment Company, Inc.,
355 North Washington,
Wichita, Kansas.

Attention: J. D. Jarvis, President.

Dear Jim:

A recent analysis of our drilling cost operations gave us some interesting information on the operation costs of the General Motors, Series 71, Twin diesel engines which power each of our Unit Rig Company U-15 drawworks and 7¼" X 12" Gardner-Denver mud pumps.

Our two General Motors, Series 71 Twins have drilled a total footage of 405,591 feet in 1408 operating days, operating approximately 31,680 hours. Total engine maintenance costs, which include all repairs and mechanics' time and transportation, for this period was $6,283.28. Our maintenance cost on these engines has been approximately 1¢ per foot of hole drilled; the exact figure is $0.01549 per foot. Incidentally the above cost figures include a major overhaul for the engines on our oldest rig. Fuel consumption averages 10.6 gallons per hour per twin engine and our fuel cost has averaged approximately 13c per gallon.

All service and repair work has been performed by your Company's Great Bend branch. Our Mr. Cecil Burton, drilling superintendent, attributes a large part of the successful and low cost performance of these engines to the attention given them by your service men. Their instruction and advice to our drillers has enabled our crews to operate these engines in a most efficient manner.

We are highly pleased with the trouble free and economical operation of these G M Twin diesel engines and do not hesitate to recommend them to other drilling contractors.

With every good wish for your continued success, we are

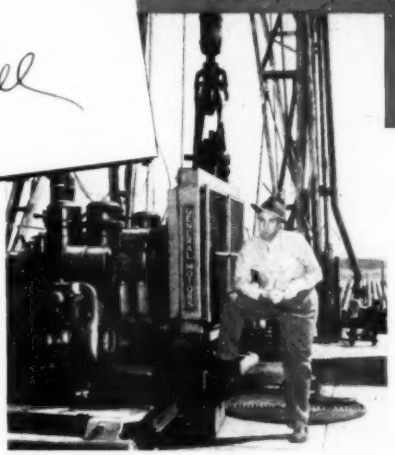
Very truly yours,

PICKRELL DRILLING COMPANY

Lloyd R. Pickrell

Lloyd R. Pickrell

LRP:ez



Here's convincing proof that General Motors Diesel engines cost less to maintain. It's one of the reasons this modern, 2-cycle Diesel power is the favorite of drilling contractors everywhere. Find out how much more GM Diesels have to offer. See your nearest distributor or drop us a line.

GM GENERAL MOTORS DIESEL POWER

DETROIT DIESEL ENGINE DIVISION

SINGLE ENGINES . . . Up to 275 H.P. **DETROIT 28, MICHIGAN** MULTIPLE UNITS . . . Up to 800 H.P.

GENERAL MOTORS

DIESEL BRAWN WITHOUT THE BULK

ANSWER THE CALL CIVIL DEFENSE

GENERAL MOTORS CORP., DIESEL ENGINE SALES, PETROLEUM INDUSTRY, 1504 Philtower Bldg., TULSA 3, OKLAHOMA

CALIFORNIA: Anderson-O'Brien Co., LOS ANGELES 21; Lawless Brothers, BAKERSFIELD; West Coast Engine & Equipt. Co., BERKELEY. **ILLINOIS:** Western Machinery & Engine Co., CENTRALIA. **KANSAS:** Diesel Equipment Co., Inc., WICHITA. **COLORADO:** Colorado Builders' Supply Co. (Equipt. Division), DENVER. **LOUISIANA:** George Engine Co., Inc., HARVEY; United Tool Company, SHREVEPORT. **MISSISSIPPI:** Taylor Machine Works, JACKSON. **MISSOURI:** Western Machinery & Engine Co., ST. LOUIS 10. **MONTANA:** Seitz Machinery Co., Inc., BILLINGS; Mountain Tractor Co., MISSOULA. **OKLAHOMA:** Diesel Power Co., OKLAHOMA CITY. **TEXAS:** Stewart & Stevenson Services, Inc., HOUSTON 1, McALLEN, DALLAS, CORPUS CHRISTI, WICHITA FALLS; Haynes Machinery Co., PLAINVIEW; Empire Machinery Co., Ltd., ODESSA. **WYOMING:** Colorado Builders' Supply Co. (Equipt. Division), CASPER.

This month we'll ship our 30,863rd mile of large diameter welded line pipe

This month we will have shipped 30,863 miles (4,612,495 tons) of A. O. Smith Line Pipe for the world's growing pipe line networks.

In the latter part of 1927, when A. O. Smith introduced its large diameter, high strength, welded line pipe, the entire industry could turn out no more than three miles of large diameter pipe per day. *By 1928,* A. O. Smith had increased its capacity to more than 15 miles per day.

Virtually overnight A. O. Smith opened the way for the construction of many contemplated lines which were not economically possible until an adequate and assured supply of pipe was available.

Since that time, by every means known to science, the SMITHWAY process of pipe manufacturing has been ceaselessly developed and perfected, offering ever greater assurance of accuracy, uniformity and reliability.

Today A. O. Smith is still the leader in the development and manufacture of large diameter line pipe and practically every major pipe line is wholly or partly built of our pipe.

DEPENDABILITY through RESEARCH and ENGINEERING

A.O.Smith

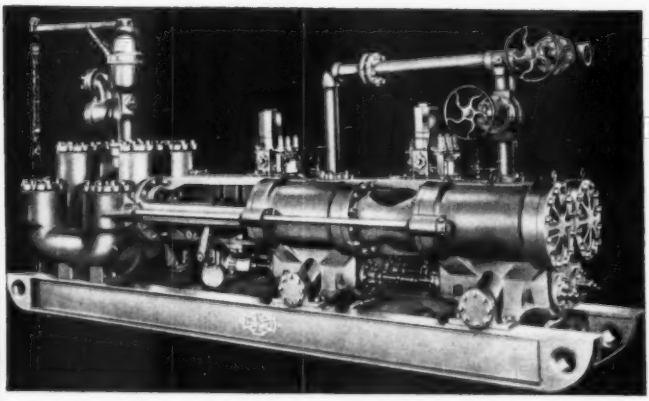
CASING • LINE PIPE

Chicago 4 • Dallas 2 • Denver 2 • Houston 2 • Los Angeles 22
Midland 5, Texas • New Orleans • New York 17
Pittsburgh 19 • San Francisco 4 • Seattle 1
***International Division:* P.O. Box 2023, Milwaukee 1**

the WHELAND
QUAD STEAM PUMP

H-20000-BAB 16½" x 16½" x 20" – 8", 7½", 7"

- **Eliminates compounding troubles**
- **Either one or both steam cylinders may be used as desired**
- **More economical than two separate pumps**



- **Equivalent to a two cylinder duplex pump with cylinders 23-5 16" bore**
- **Steam horsepower equivalent to two 16½" x 20" x 8" pumps**
- **2,875 lb. mud pressure at 300 lb. steam with 8" liners**
- **9.584 to 1 steam to water ratio with 8" liners**
- **Liners need changing less frequently**
- **"Upside down" steam ends, patented**
- **Net weight only 32,800 lbs., with skids**

Here's a pump with all the "guts" for big steam rigs. The specifications below tell its story, and each day the units in operation demonstrate the efficiency and values of WHELAND H-20000-BAB QUAD PUMP.

H-20000-BAB WHELAND QUAD STEAM PUMP SPECIFICATIONS

Steam cylinders	16½" and 16½" x 20"
Hydrostatic test on steam cylinders	700 P.S.I.
Steam pressure, maximum working pressure	350 P.S.I.
Speed, normal R.P.M. each side	50
Steam pipe size to each cylinder	4"
Exhaust pipe size from each cylinder	4"
Main cylinder, piston rod diameter	3¾"
Auxiliary cylinder, piston rod diameter	3¼"
Water piston rod diameter	3⅛"
Water piston rod fitted for No. 6 A.P.I. piston tie rods, diameter	2¼"

FLUID END

Material, solid one piece steel casting	
Hydrostatic tested, discharge ports to	6000 P.S.I.
Hydrostatic tested, suction ports to	3000 P.S.I.
Maximum working pressure recommended	3000 P.S.I.
Discharge pipe, standard size	4"
Suction pipe, standard size	10"

COMPLETE MECHANICAL DETAILS ON REQUEST

LUCEY

LUCEY EXPORT CORPORATION

233 BROADWAY . . . NEW YORK 7, N. Y.

Bread Street House, London, E. C. 2, England • Sterling Building, Houston, Texas • Calle Defensa 320, Buenos Aires, Argentina • San Fernando, Trinidad, B. W. I. • Calgary and Edmonton, Alberta, Canada

There's ONE BEST ENGINE FOR EVERY APPLICATION ...THE... CONTINENTAL RED SEAL

TAILORED TO THE JOB

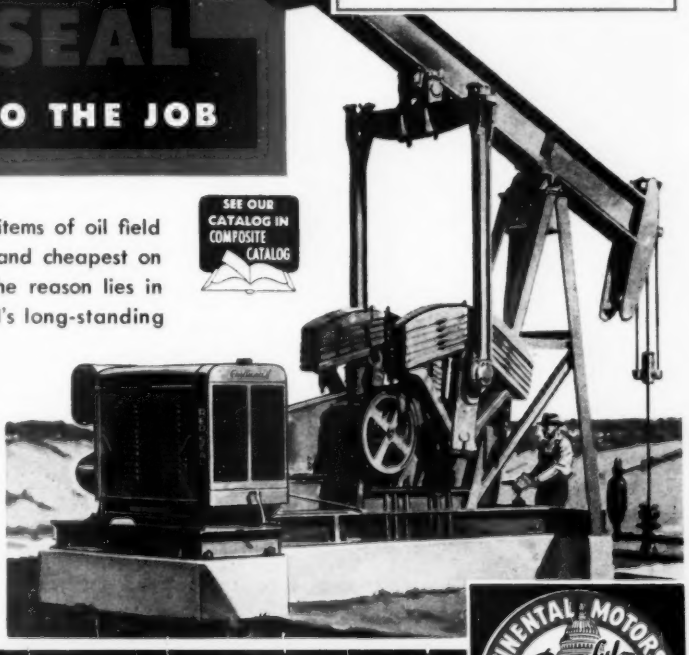
INDUSTRIAL GASOLINE ENGINES

Model	Cyl.	Bore	Stroke	Displ.	Bare Engine H.P.
N56	4	2⅛	3½	56	13 @ 2000 RPM
N62	4	2⅛	3½	62	16 @ 2200 RPM
Y69	4	2⅛	3½	69	21.4 @ 2400 RPM
Y91	4	2⅞	3½	91	28.5 @ 2400 RPM
Y112	4	3⅛	3½	112	32 @ 2400 RPM
F124	4	3	4⅛	124	36 @ 2400 RPM
F140	4	3⅛	4⅛	140	42 @ 2400 RPM
F162	4	3⅜	4⅛	162	49 @ 2400 RPM
F186	6	3	4⅛	186	60 @ 2400 RPM
F209	6	3⅛	4⅛	209	68 @ 2400 RPM
F226	6	3⅛	4⅛	226	73 @ 2400 RPM
M271	6	3⅜	4⅛	271	86 @ 2400 RPM
M290	6	3⅛	4⅛	290	92 @ 2400 RPM
M330	6	4	4⅛	330	104 @ 2400 RPM
B371	6	4⅛	4⅛	371	106 @ 2200 RPM
B427	6	4⅛	4⅛	427	122 @ 2200 RPM
G134	4	3⅛	4⅛	134	32.2 @ 2000 RPM
G157	4	3⅛	4⅛	157	37.7 @ 2000 RPM
H227	4	3⅛	5½	227	54 @ 2000 RPM
H243	4	3⅛	5½	243	58 @ 2000 RPM
H260	4	3⅛	5½	260	60.2 @ 1800 RPM
T371	6	4⅛	4⅛	371	119 @ 2400 RPM
T427	6	4⅛	4⅛	427	140 @ 2400 RPM
U501	6	4½	5¼	501	160 @ 2400 RPM
R513	6	4½	5⅛	513	164 @ 2400 RPM
R572	6	4¾	5⅛	572	182 @ 2400 RPM
R602	6	4⅞	5⅛	602	192 @ 2400 RPM
S749	6	5⅛	5½	749	188.5 @ 1800 RPM

INDUSTRIAL DIESEL ENGINES

Model	Cyl.	Bore	Stroke	Displ.	Bare Engine H.P.
GD157	4	3⅜	4⅛	157	37.5 @ 2000 RPM
HD243	4	3¾	5½	243	53.1 @ 2000 RPM
HD260	*4	3⅞	5½	260	57 @ 2000 RPM
TD427	6	4⅛	4⅜	427	102 @ 2000 RPM
RD572	6	4¾	5⅛	572	137 @ 2000 RPM

*Available for Industrial applications only.



SEE OUR CATALOG IN COMPOSITE CATALOG

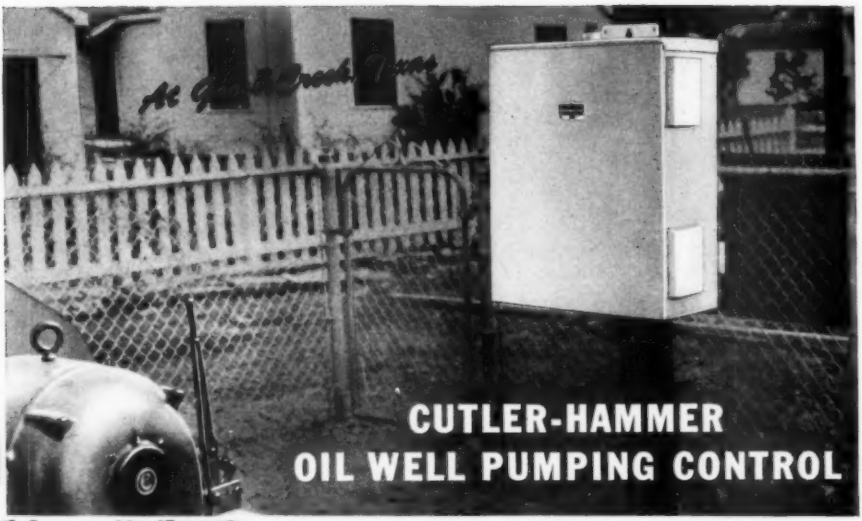
Few and far between are the items of oil field equipment that won't run best and cheapest on Continental Red Seal power. The reason lies in specialization — in Continental's long-standing policy of engineering each model precisely to its work. Continental builds to more than 1,000 different specifications to place at your disposal the one best power source for your job.

REMEMBER, ANY EQUIPMENT IS BETTER WITH CONTINENTAL RED SEAL POWER

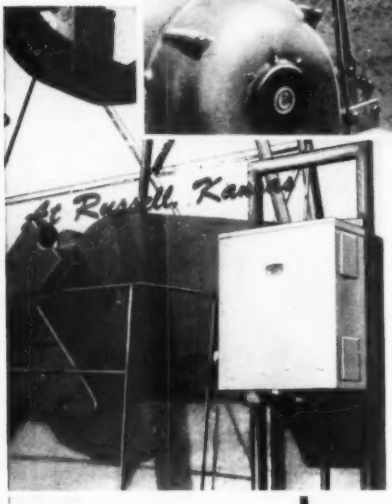
Continental Motors Corporation
MUSKEGON, MICHIGAN

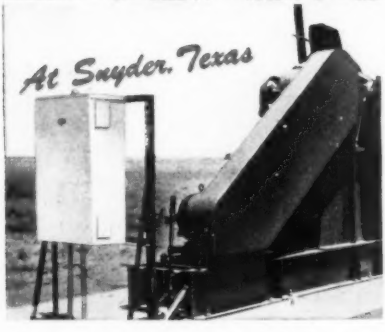
6218 CEDAR SPRINGS ROAD, DALLAS 9, TEXAS . . . 3817 S. SANTA FE AVE., LOS ANGELES 58, CALIF.

CONTINENTAL MOTORS · Powerful as the Nation · AMERICA'S STANDARD



CUTLER-HAMMER OIL WELL PUMPING CONTROL





Built for the toughest conditions
Right for any conditions

It can truthfully be said the Cutler-Hammer Oil Well Pumping Control has been designed and built in response to the practical operating needs of the oil country. It has been built to withstand climatic extremes . . . hot, dusty, insect and storm prevalent conditions . . . or salt-laden, hot, humid atmospheres. It has the "stuff" to stand up anywhere.

The controller case has 4 openings for *adequate* ventilation. The aluminum painted case reflects the sun's heat. You don't have to prop the door open to dirt and insects to keep this starter cool.

The ventilators are fine mesh screened, louvered and plate-guarded to keep out dirt, dust and bugs. The vertical contacts shed dust. The timer case is neoprene-gasketed and dustproof . . . the clock motor has extra power—keeps on running—dependably.

Unit type lightning arresters show their condition at a glance. If one blows, it's clean . . . you don't have to disassemble the starter to clean up afterwards. This control is available without undervoltage relay or *with* undervoltage relay, but the popular type with automatic staggered restarting requires no attention should power fail during a storm, because *proper* restarting is automatic in preset and adjustable intervals. Changes in pumping schedule are easy, accurate. Reset of timer clock is performed by turning a handy palm-sized dial. Wiring diagram with spare parts list and overload heater coil ratings is plastic-covered against grease, sweat, dirt, moisture and wear. These are but a few of the features that make the Cutler-Hammer Oil Well Pumping Control outstanding in the field. CUTLER-HAMMER, Inc., 1453 St. Paul Avenue, Milwaukee 1, Wisconsin. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto, Ontario.

OTHER CUTLER-HAMMER PRODUCTS FOR THE INDUSTRY

Famous Cutler-Hammer UNITROL Control Center
Groups controls in one centralized, flexible housing. All parts interchangeable. Simplifies installation and wiring. Sections easily added. Simplifies servicing and insures better periodical inspection.

Bulletin 9586 Across the Line Starter
For standard or high torque polyphase squirrel cage motors. Famous features, *vertical* dust-safe contacts, eutectic alloy overload relay. Rugged construction, ample reserve. Dust-tight or water-tight enclosing case.

CUTLER-HAMMER
MOTOR CONTROL
C-H

THE GOOD EARTH *is our business..*

IN THE course of eighteen years of service to a long list of important oil producers throughout the world, Independent has accurately surveyed countless miles of the earth's subsurface. This richness in practical experience, paralleled by continuing laboratory research in the several sciences on which geophysics is built, is your assurance of profitable satisfaction with the services of Independent Exploration Co.

Party Chief W. H. Morgan has accumulated 15 years of varied experience with IX crews since he graduated from Illinois University. Every man who serves as a party chief for Independent must be well qualified, by training and field experience, to direct exploration work that is profitable for our clients.

POINTING THE WAY FOR THE DRILL

IXC

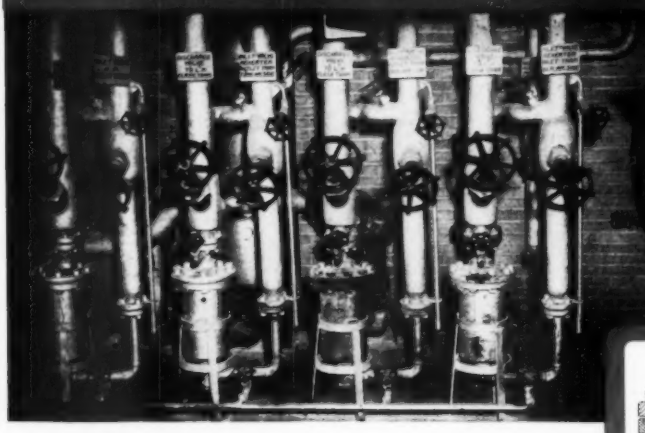
Independent *Geophysical Surveys*

EXPLORATION COMPANY

1973 WEST GRAY ★ HOUSTON, TEXAS

ESTABLISHED 1932

FORGED STEEL
steam traps



List of Materials

CAP and BODY FORGINGS:*
Up to 600 psig—S.A.E. 1030 steel
600 to 900 psig—ASTM F-1 moly-steel
900 to 1500 psig—ASTM F-7 chrome moly-steel

VALVE AND SEAT:
Chrome steel, heat treated

BUCKET and VALVE LEVER ASSEMBLY:
18-8 Stainless Steel

BOLT and NUT SET:*
Bolts Class C, 125,000 lbs. tensile
Nuts, hex, semi-finish, S.A.E. 1030

GASKET:*
Compressed graphited asbestos

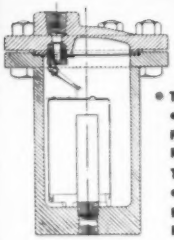
*Does not apply to No. 3211 nor No. 913

1. FOR HIGH PRESSURE SERVICE — engineers responsible for the design or operation of high pressure, high temperature steam plants can specify with confidence Armstrong Forged Steel Steam Traps to provide completely automatic condensate drainage throughout. These traps are "standard" in leading power stations throughout the entire world where they are used for draining headers, desuperheaters, soot blowers and other drip points at pressures as high as 2400 psig! These traps always open when filled with condensate and there is no steam loss under no-load conditions. Safety and dependability are assured through use of modern materials, highest quality workmanship and critical inspection.

2. FOR ALL-STEEL INSTALLATIONS — Armstrong Forged Steel Traps also ideally meet the increasing demand in power plants, refineries and general industry for all-steel fittings on lower pressures (up to 250 psig) because they are light in weight and surprisingly low in price. They provide the maximum in safety, dependability, shock and fire resistance.

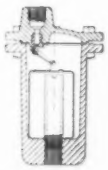
● FOR COMPLETE DATA ask for the 36-PAGE ARMSTRONG STEAM TRAP BOOK or see our catalog in Sweet's.

ARMSTRONG MACHINE WORKS
868 Maple Street, Three Rivers, Michigan

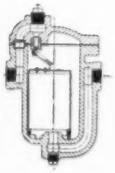


● Traps with screwed connections for pressures to 900 psig.

Traps with flanged connections for pressures to 2400 psig.



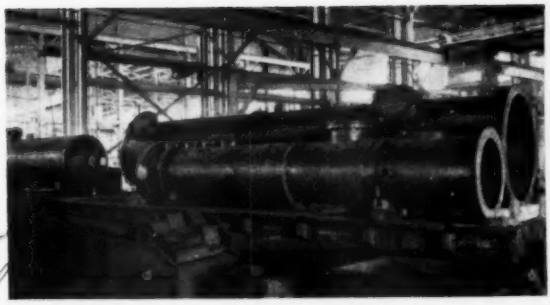
● No. 3211 trap for pressures to 250 psig, only $29.00.



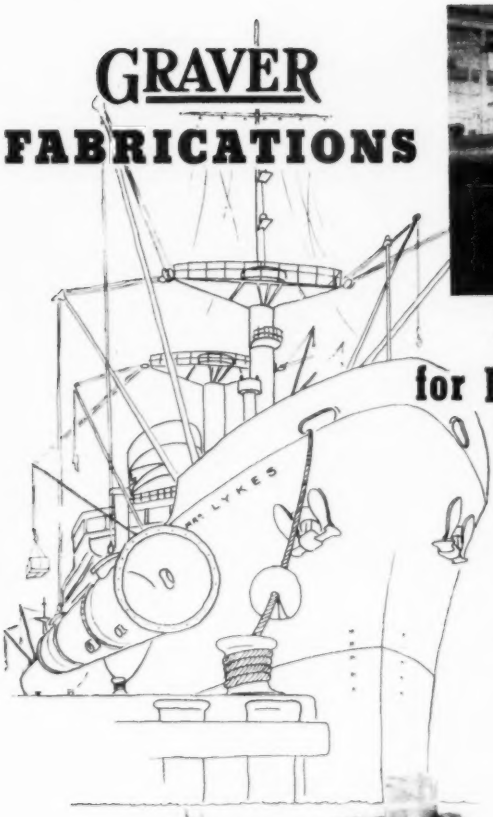
● Side inlet cast steel trap for pressures to 600 psig, screwed or flanged connections.

ARMSTRONG STEAM TRAPS

GRAVER FABRICATIONS



Three of the Graver-built vessels ready to leave East Chicago plant on long trip to England via New Orleans.



for Europe's Largest Refinery

● For the mammoth new Esso Petroleum refinery at Fawley, England, Graver's East Chicago and Catasaqua plants fabricated a number of API tanks and vessels:

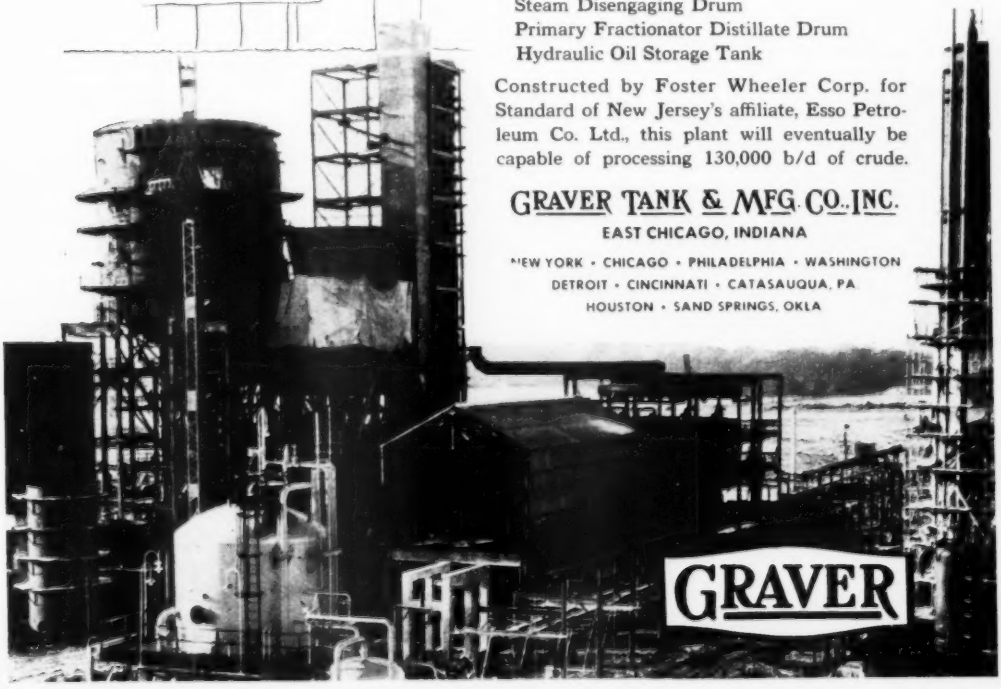
Slurry Settler Drum
Condensate Surge Tank
Explosivity Convector
Heavy Cycle Gas Oil Stripper
Boiler Blowdown Drum
Hydraulic Oil Accumulator
Catalyst Gas Compressor Suction Knockout Drum
Light Heating Oil Stripper
Steam Disengaging Drum
Primary Fractionator Distillate Drum
Hydraulic Oil Storage Tank

Constructed by Foster Wheeler Corp. for Standard of New Jersey's affiliate, Esso Petroleum Co. Ltd., this plant will eventually be capable of processing 130,000 b/d of crude.

GRAVER TANK & MFG. CO., INC.

EAST CHICAGO, INDIANA

NEW YORK • CHICAGO • PHILADELPHIA • WASHINGTON
DETROIT • CINCINNATI • CATASAUQUA, PA.
HOUSTON • SAND SPRINGS, OKLA.



J&L STEEL

THIS MAN'S LOOKING FOR SCRAPPERS!

HE'LL BE SEEING YOU!

Be Ready for Your District's Scrap Representative!

The big fight's on to lick the scrap shortage!

The shortage is so critical that many steel plants have only a few days scrap on hand.

Get in the fight! Get in the scrap!

The steel industry has mobilized to go out and get desperately needed scrap. Scrap representatives have been appointed in your district. One will call on you soon.

Welcome him . . . be ready for him. Survey your plant *before* he comes so you can tell him how much scrap you can move . . . *or have already moved* . . . to the mills through your scrap dealer.

HERE'S WHAT'S WANTED

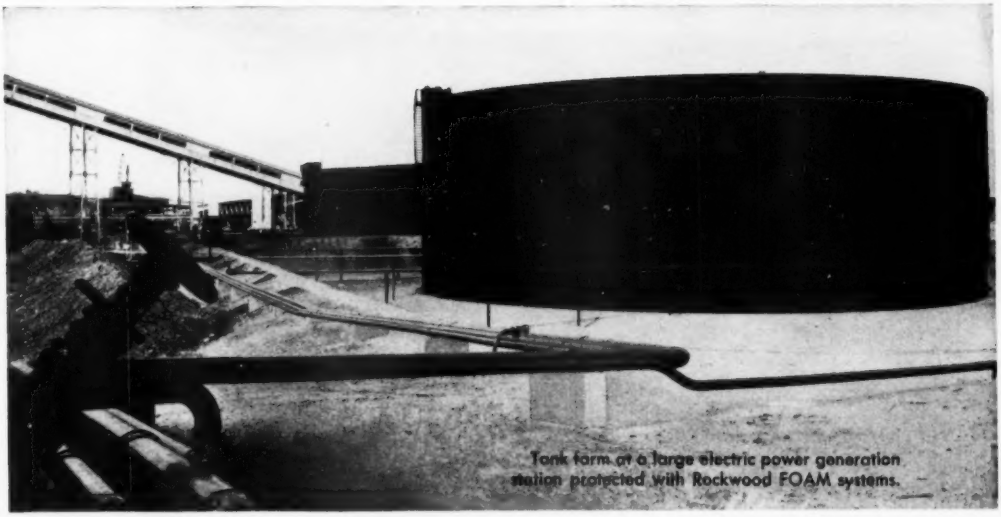
Steel mills need tons and tons of scrap over and above "working scrap" which you normally sell. Broken or obsolete machinery and equipment . . . odds and ends . . . rails . . . worn out parts—in fact *all* the iron or steel material that's gathering dust in your plant.

Put a responsible man in charge of rounding up scrap in your plant. *Do it now.* Unless dwindling scrap piles are replenished *immediately* steel production will suffer *immediately.*

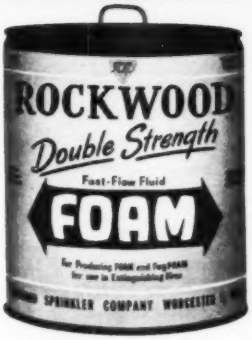
Be a Scrapper for Steel... FOR AMERICA

JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH 30, PA.



Tank farm at a large electric power generation station protected with Rockwood FOAM systems.



better FIRE PROTECTION begins with ROCKWOOD PRODUCTS

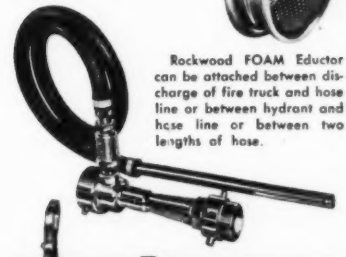
You'll be surprised at all the places in your refinery — plant or city where Rockwood fire fighting products can help you *cut fire losses.*

Year after year Rockwood engineers stride ahead giving fire fighters spectacular new developments to combat serious fires in highly volatile flammable liquids and materials. One of the most recent developments has been the new Rockwood *Double strength* FOAM liquid. This new type extinguishing agent is a *fast-flowing* FOAM that covers burning surfaces faster — completely seals off combustible vapors — flows freely at sub-zero temperatures (-15°F) and is easier for firemen to handle. It will cling to smooth, vertical or curved surfaces and has many advantages over ordinary FOAM liquids or powder foams.

New Rockwood proportioning equipment, FOAM and Fog-FOAM Nozzles enables fire fighters to apply Rockwood FOAM Liquid and wetting agent more efficiently to most fires.

Ask your fire equipment distributor, today for complete data and prices on Rockwood's growing family of modern fire fighting products.

New Lightweight type FFF Rockwood FogFOAM Nozzle. Discharges FogFOAM — solid FOAM stream or High Velocity WaterFOG. →



Rockwood FOAM Eductor can be attached between discharge of fire truck and hose line or between hydrant and hose line or between two lengths of hose.

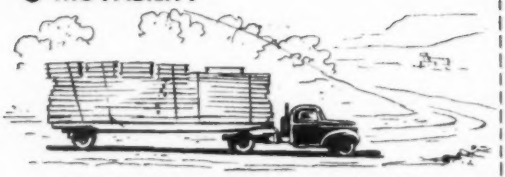
Rockwood Lightweight "FF" Extension unit with SG-60 WaterFOG Nozzle attached. Discharges FogFOAM, solid FOAM stream, high velocity WaterFOG, solid stream or low velocity WaterFOG.

ROCKWOOD SPRINKLER CO.
104 HARLOW STREET, WORCESTER 5, MASS.
PORTABLE FIRE PROTECTION DIV.

ROCKWOOD

WHY STURDYBILT *Prefabricated* HOUSES ARE *BEST* FOR OIL FIELD HOUSING . . .

● MOVABILITY



Houses, in complete packages, are moved from factory to site, or from one site to another with a minimum of delay, and practically no loss of material.

● NO WASTE

Material cost is cut to the minimum because YOU PAY ONLY FOR THE MATERIAL USED. Sections are Prefabricated, and material is cut to fit at the factory.

● SPEED OF ERECTION

Houses delivered in sections are erected in days instead of weeks. Thus you save much costly time of on-the-job labor.

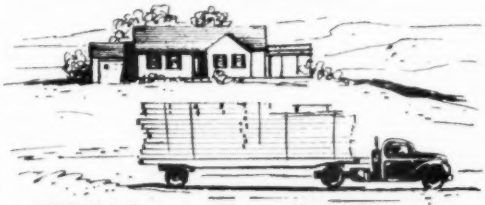
● VARIETY OF DESIGNS

Wall sections can be arranged in so many ways, scores of styles and floor plans from tool houses to warehouses are available.

● WEATHER TIGHT

STURDYBILT sections are precision-built on jigs to assure fitting accuracy. They are tongue and grooved to assure weather-tight construction.

● PERMANENT or TEMPORARY



STURDYBILT Houses over 30 years old are still in use. This record of durability proves that STURDYBILT Houses, although movable, fill the bill for permanent housing.

MANUFACTURERS OF SPECIAL MILLWORK • DISTRIBUTORS OF JOHNS-MANVILLE BUILDING MATERIALS • CURTIS WOODWORK

STURDYBILT

PREFABRICATED, DEMOUNTABLE HOUSES

SOUTHERN MILL & MANUFACTURING CO. • TULSA, OKLAHOMA

STURDYBILT HOUSES COMPLY WITH COMMERCIAL STANDARD CS125 OF THE NATIONAL BUREAU OF STANDARDS FOR PREFABRICATED HOMES

LIKE A GUN!

THE NEW ALFCO PRESSURIZED FIRE-GUN

AIMS·SHOOTS·HITS THE FIRE TARGET···

The new Alfco Pressurized Fire-Gun is a lightweight one quart unit, designed for one hand operation on Class B and C fires. It can be aimed like a gun, with its trigger-quick stream hitting the fire target instantly and accurately. No training is required to operate it effectively. Anyone can do it.

It discharges Fire-Gun Fluid which is air expelled by a stored pressure of from 125 to 175 psi at 70° F. It is designed to resist a minimum bursting pressure of 900 psi. The design and construction of this one quart Fire-Gun are such that parts will not work loose in service. All movable parts can be serviced.

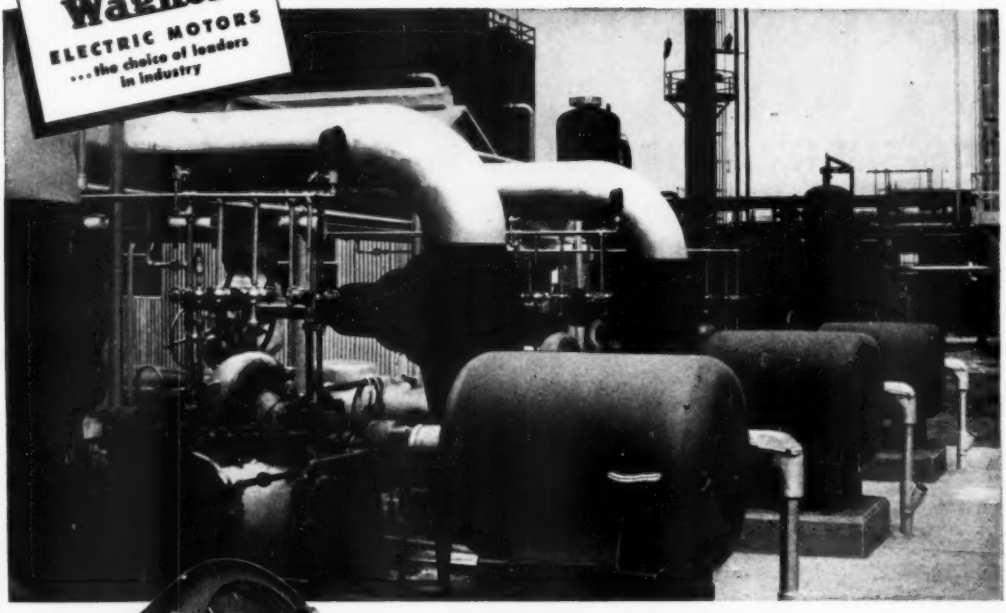
Over 95% of its contents can be discharged when the extinguisher is held in any position from vertical to within 15° of horizontal. Its effective range is 25 to 30 ft. at 70° F. for the bulk of the liquid. Discharge time is 35 seconds at 70° F. Its operation is good down to −40° F. It is easily recharged, and can be air pressurized by any standard air chuck exerting 150 psi.

This is the newest and most effective one quart fire extinguisher for Class B and C fires we have yet designed. Inspected and approved by Underwriters' Laboratories. Write for illustrated literature

AMERICAN-LAFRANCE-FOAMITE Corporation
ELMIRA·NEW YORK·U.S.A.

ALFCO

Wagner
ELECTRIC MOTORS
...the choice of leaders in industry



Wagner explosion-proof motors

Time-tested favorites of the oil fields

Wagner Explosion-Proof Motors are a familiar sight in the great refineries and oil fields of the nation. There's a reason—these motors are especially designed to operate with complete safety and dependability in explosive atmospheres. And, they operate reliably in exposed outdoor locations because they are fully protected against dust, sand, rain or snow.

The installation above shows 100 horsepower Wagner explosion-proof motors driving hot oil pumps at a large refinery in the Southwest . . . it is typical of thousands of applications where specialized requirements are met from Wagner's complete line of standard motors.

Wagner Explosion-Proof Motors are available in ratings up to 250 horsepower and are varied electrically to suit a wide variety of application requirements. Bulletin MU-185 gives information on the complete line of Wagner Motors . . . do *you* have a copy?

Wagner engineers are qualified to specify the correct motor for your exact needs. Consult the nearest of our 31 branch offices, or write us.

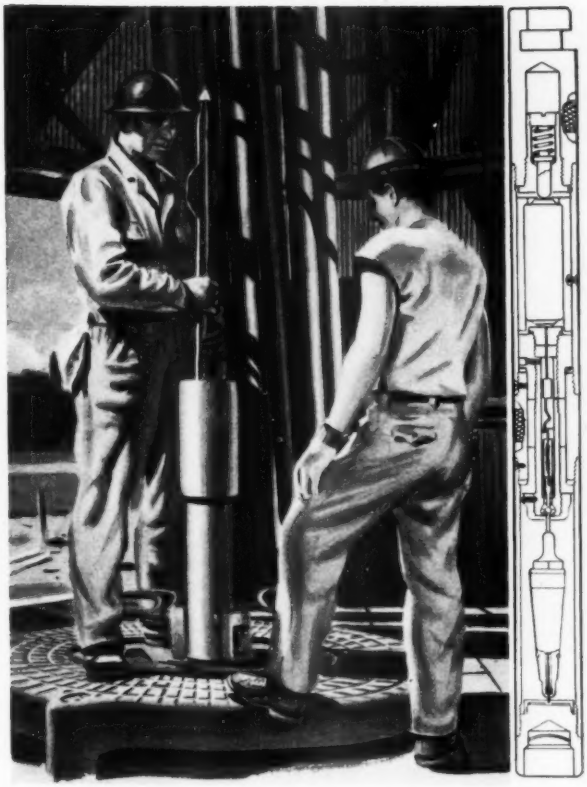
WAGNER ELECTRIC CORPORATION
6389 Plymouth Ave., St. Louis 14, Mo., U.S.A.

Wagner Electric Corporation
1891 1951

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS – AIR AND HYDRAULIC

BRANCHES IN 31 PRINCIPAL CITIES

MU-9



SERVICE SPEED ACCURACY

Yours with the E-C Inclinometer

SPERRY-SUN SERVICE on its instruments means they are serviceable when you are ready to use them.

The E-C Inclinometer records *automatically* and *immediately* after coming to rest. It can be go-deviled or lowered into the hole on a line by any conventional method in either rotary or cable tool operation.

The record is made by small electrical current which makes a dot on the recording disc only when the E-C is at rest. To double-check with an E-C, just raise it a few feet and again lower it to the previous depth. In this way you check for movement of the instrument and alignment of the axis of the instrument with the axis of the drill collar. Your reading's accuracy is then checked and double-checked.

Write for your copy of our reprint from the 18th edition of the Composite Catalog for details on all of our services and instruments.

SPERRY-SUN WELL SURVEYING COMPANY

3118 BLODGETT AVENUE HOUSTON, TEXAS

Philadelphia, Pa. Fallurrias, Odessa, Marshall, Texas Long Beach, Ventura, Bakersfield, Calif.
Oklahoma City, Okla. Lafayette, La. Moxiden Oil Field Services, Casper, Wyo. Crossville, Illinois

Most of the World's Newest Pipelines

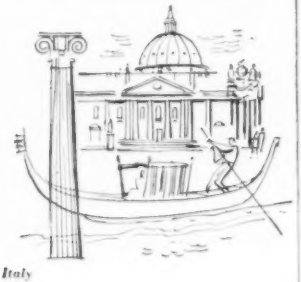
are tied together with

W-K-M PIPELINE VALVES

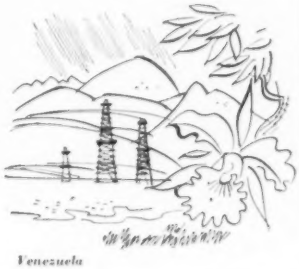
Arabia

U.S.A.

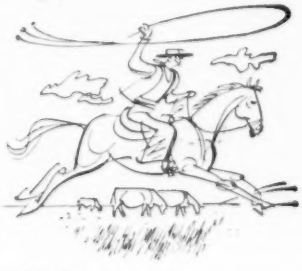
France



Italy



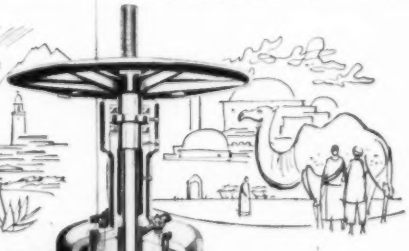
Venezuela



Argentina

Mexico

Bolivia



Kuwait

W-K-M Company

OIL FIELD PIPELINE & INDUSTRIAL EQUIPMENT

HOUSTON, TEXAS, U.S.A.

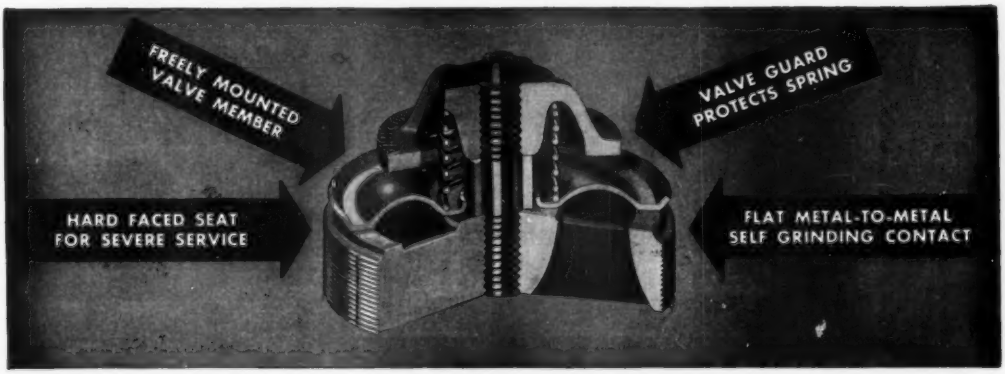
LOS ANGELES

Cable Address: "WILKOMAC"

Export Office: 30 Rockefeller Plaza, New York, N.Y.

DURABLA

METAL PUMP VALVE UNITS
KEEP YOUR PUMPS IN SERVICE


FREELY MOUNTED VALVE MEMBER
VALVE GUARD PROTECTS SPRING
HARD FACED SEAT FOR SEVERE SERVICE
FLAT METAL-TO-METAL SELF GRINDING CONTACT

1 **THEY ARE SELF-GRINDING:** Durabla Valve Units*, utilizing the freely mounted arched construction valve member exclusive to Durabla, are self-grinding, as the flat portion of the valve member is in direct contact with the flat valve seat and is free to move about its axis, thus producing a constant self-grinding action.

2 **VALVE SEATS ARE HARD FACED FOR SEVERE SERVICE:** Providing a seat surface hardness of Rockwell C-48-52 (approximately 500 Brinnel) or more in special valves, Durabla Valve Units have a long record of effective service with **FLUIDS CARRYING SUSPENDED ABRASIVE SUBSTANCES.** The metal valve member effectively prevents the pitting or "pick-up" of abrasive substances sometimes occurring with valves made of other materials.

3 **VALVE SPRINGS AND VALVE STEMS ARE PROTECTED:** The Valve Guard protects the Valve Spring from ever compressing more than 50% of its length. The Valve Stem is protected against breakage by the free mounting of the Valve Member.

Economy, efficiency and adaptability, based on long established service records and exclusive design make Durabla Valves your guarantee of reliable, uninterrupted pump operation.

You can specify Durabla Valves when you order a pump, (many manufacturers use them as standard equipment), or you can order Durabla Valves to fit any type of reciprocating pump, (they come with drive-fit seats or threaded seats with or without a shoulder to suit the job).

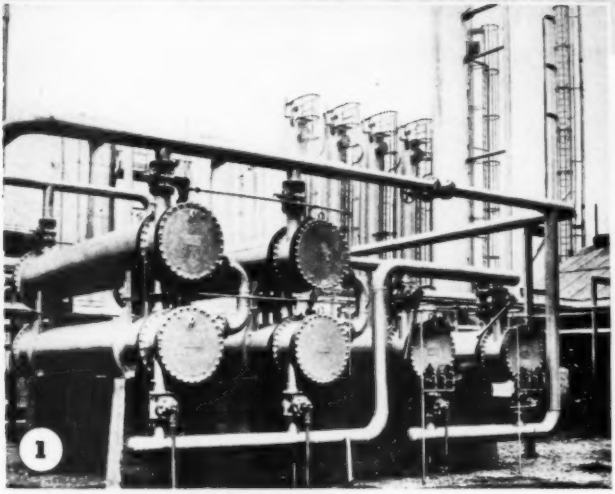
TO AVOID "PUMP TROUBLES" SPECIFY DURABLA VALVES

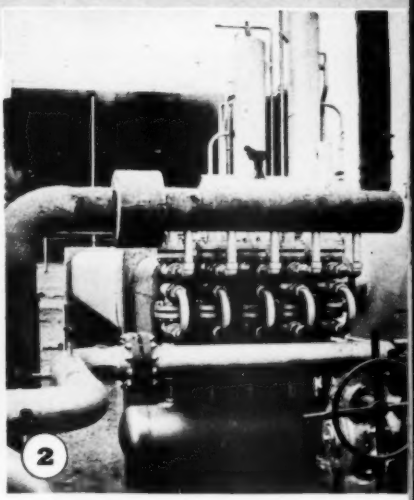
Address DURABLA Engineering Department for information and bulletin: Reference OG-12

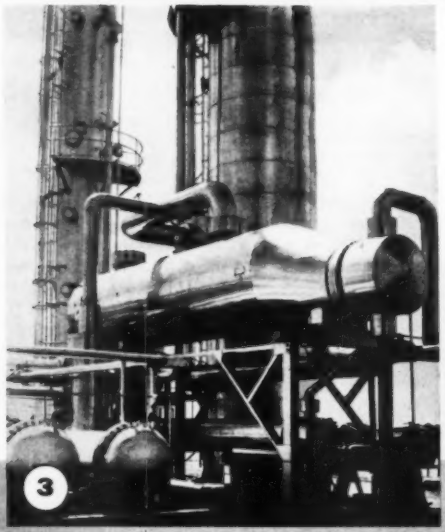
*Patent Numbers 2090486, 2117504

DURABLA MANUFACTURING COMPANY
114 LIBERTY ST. NEW YORK
BRANCHES IN PRINCIPAL CITIES. FOR CANADA REFER: CANADIAN DURABLA LIMITED, TORONTO

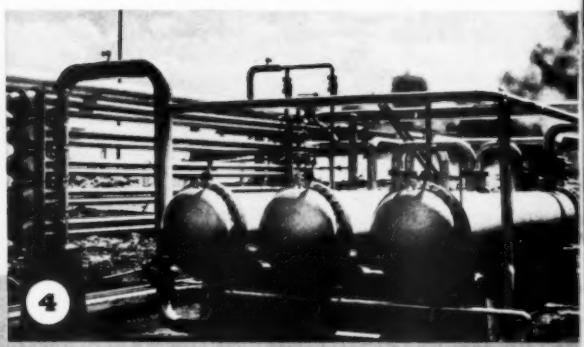
Heaters, Coolers, Exchangers,







1. 6 G-R Tubular Exchangers handling glycol-amine on both shell and tube sides
2. 10 G-R Twin Bare Pipe Section Regeneration Gas Heaters
3. G-R Solution Reboiler, and G-R Tubular Secondary Exchangers
4. 10 G-R Twin G-Fin Section Primary Exchangers, and 3 G-R Tubular Secondary Exchangers



GRISCOM-RUSSELL • PIONEERS IN HEAT TRANSFER APPARATUS

Reboilers...all G-R

The El Paso Natural Gas Company has so many installations of G-R Heat Transfer apparatus that a complete list would be difficult to compile.

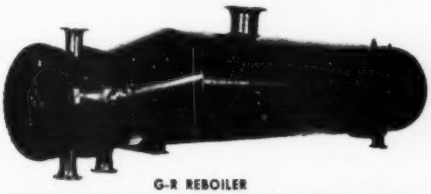
However, the accompanying photographs, taken at random at Jal, New Mexico, indicate the wide range of services for which the Company uses G-R apparatus. The illustrated G-R units include Twin G-Fin Section Primary Exchangers, Type FST Tubular Secondary Exchangers, a G-R Solution Reboiler, and Twin Bare Pipe Regeneration Gas Heaters.

This company, like so many others throughout the oil and gas industry, has evidenced its satisfaction with G-R Heat Transfer Apparatus in the most unequivocal and convincing manner — by wide use and by repeat orders.

You, too, can be assured of satisfactory service from heat transfer apparatus by standardizing on G-R. When doing so, you get the benefit of the unequalled G-R experience, the extensive variety of G-R designs, and the long-proven merit of G-R apparatus. Whatever may be your heat transfer needs . . . condensing, cooling, heating or heat exchange . . . be sure to consult the G-R engineers for their authoritative advice.

G-R TUBULAR EXCHANGER
A shell-and-tube unit with many distinctive features for efficient performance with minimum attendance and maintenance expense.

G-R TWIN G-FIN SECTION
The "universal" standard interchangeable heat transfer unit with longitudinally-finned elements. More than 40,000 installed sections.



G-R REBOILER
Widely used in process industries, and available with either bare tubes or K-Fin helically finned elements.

THE GRISCOM-RUSSELL CO., MASSILLON, OHIO

GRISCOM-RUSSELL

GR 250

QO FURAN CHEMICALS

THE QUAKER OATS COMPANY

Announces

the completion of its NEW
QO-Furfural Plant at Omaha, Nebraska

The Quaker Oats Company's Omaha Chemical Plant is now producing the industrially important chemical, QO-Furfural. This chemical is made from raw materials such as corn cobs and oat hulls which are replaceable yearly.

The first QO-Furfural was produced at Cedar Rapids, Iowa 29 years ago. Now this versatile chemical is made not only at Cedar Rapids, but also at Memphis, Tennessee and Omaha, Nebraska.

QO-Furfural is used in refining lubricating oils, gas oil and catalytic recycle stock; extractive distillation of C_4 hydrocarbons; as a chemical intermediate in the production of nylon, furfuryl alcohol, tetrahydrofurfuryl alcohol and other chemical derivatives; as an aldehyde in resin manufacture and as a reactive solvent.

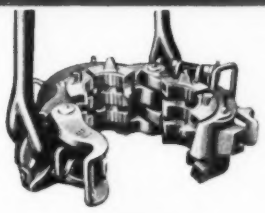
A request on your letterhead will bring you the Bulletin entitled "Current Uses of Furfural."

The Quaker Oats Company — CHEMICALS DEPT.

339A THE MERCHANDISE MART
CHICAGO 54, ILLINOIS
EASTERN SALES OFFICE:
ROOM 539A, 120 WALL ST., NEW YORK 5, N. Y.

In San Francisco The Griffin Chemical Company • In the United Kingdom, Imperial Chemical Industries Ltd., Billingham, England • In Australia, Swift & Company, Pty., Ltd., Sydney • In Europe, Quaker Oats-Graanproducten N. V., Rotterdam, The Netherlands; Quaker Oats (France) S. A. 42, Rue Pasquier, Paris 8e, France
In Japan, F. Kanematsu & Company, Ltd., Tokyo

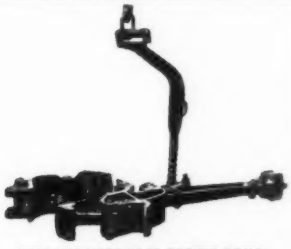
BJ DRILLING AND PRODUCTION TOOLS...



SIDEDOOR SLIP
CASING ELEVATOR

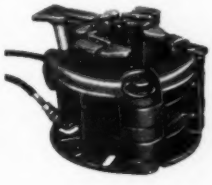
TYPE "Y" CENTER LATCH
SLIP TYPE CASING ELEVATOR
for External Upset Casing

TYPE "WS" WIDE FACE TONG

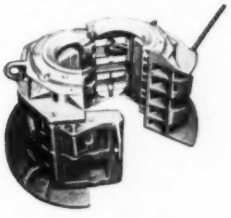


TYPE "E" WIDE FACE CASING TONG

TYPE "P" ELEVATOR
for External Upset Pipe and Casing



POWER TUBING
SPIDER



CASING SPIDER

...ARE FIELD ENGINEERED TO GIVE YOU

MAXIMUM SAFETY—BJ's consistent improvement of features that effect greater safety and operating convenience—tested to safety factors far beyond the recommended usage—provide for maximum safety, speed and efficiency on all jobs.

SPEED—BJ tools are engineered to the latest designs for fast and efficient handling. Crews work better and faster when they know that the tools they are working with have been designed and built to the highest standards of safety and strength, and that the chances of accident have been reduced to a minimum.

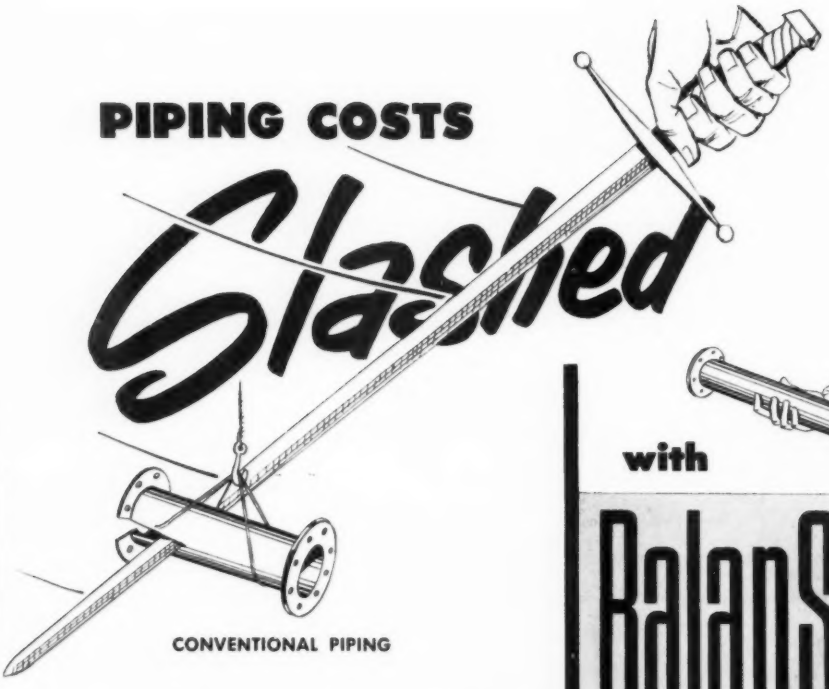
STRENGTH—the latest engineering and metallurgical research—plus continuous testing and development combine to give BJ tools the extra strength and construction advantages needed by drilling and production crews handling today's heavy equipment at high speeds.

For better performance on rigs everywhere—specify and buy BJ engineered OIL TOOLS. See your local BJ representative today.

BJ means *Engineered* OIL TOOLS

Byron Jackson Co.
Since 1872
MAIN OFFICE & PLANT: LOS ANGELES 54, CALIF.
Mid-Continent Office & Plant: Houston 1, Texas
Export Office: New York 17, New York
JOBBERS IN ALL PRINCIPAL OIL FIELDS

PIPING COSTS Slashed



CONVENTIONAL PIPING

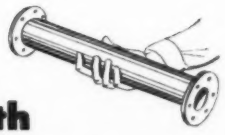
with

BalanSeal®

TYPE

FarriSeal

SAFETY VALVE



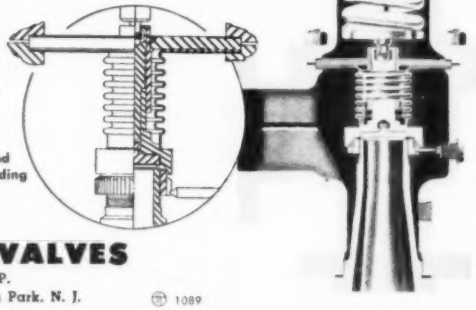
If your safety or relief valves discharge into a collecting header, you can effect substantial reduction in discharge piping cost by specifying BalanSeal Safety Relief Valves... economies that amount in some instances to *15 times as much as the cost of the valves themselves.*

HERE'S HOW: Because BalanSeal Safety-Relief Valves balance out the effects of discharge pressure surges, you can use much smaller discharge piping... can depend on your valves to operate at the set pressure regardless of how high the back pressure may be.

Besides this big economy feature of a BalanSeal installation, you get what you *must* expect of any really *safe* safety-valve—*positive protection* at all times and under all conditions of operation.

HERE'S WHY: The FarriSeal bellows seals off the stem, guide, and spring... protects them from corrosive action of the lading fluid... prevents freezing of the moving parts. Proper proportioning of the bellows diameter nullifies the effect of back pressure on the relieving point... the *only* force opposing the lifting of the disc is the spring pressure. Finally, the long, 2½ to 1 guiding ratio of the stem in the guide assures smooth action without cramping.

You can't afford to overlook the advantages of BalanSeal—for Savings and Safety. Get your copy of MANIFOLD DISCHARGE PIPING APPLICATION—Manual 51-B—a valuable reference work on this subject.



*Patented and Patents Pending

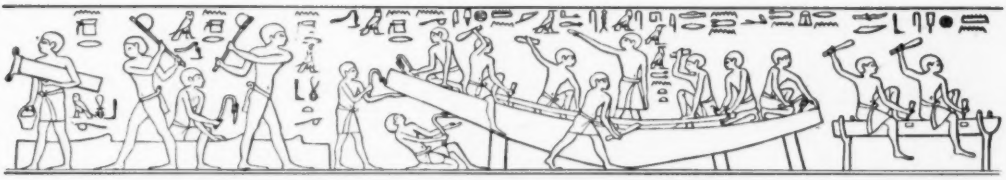
Farris

SAFETY and RELIEF VALVES

FARRIS ENGINEERING CORP.

Commercial Avenue Palisades Park, N. J.

1089



HIEROGLYPHICS · · · *with a modern meaning*

The workman of ancient Egypt knew the symbols of his trade. They helped him fashion stone and metal, wood and cloth, into the goods and structures which best served his era. . . . The needs of our modern industrial civilization are different. Visitors to Sun Ship's mighty shops see in the making the intricate steel fabric of petroleum refineries and chemical plants . . . massive bubble towers, pressure vessels, condensers, cracking cases, and a vast array of special machinery and equipment for many industries.

But even a visitor from the days of Egypt's Pharaohs would recognize two familiar facts—that strange modern "hieroglyphics" guide precise assembly of today's steel behemoths . . . and that Sun Ship workers are masters in their knowledge of the symbols and crafts of their trades. . . . The many modern industries served by Sun know these facts, too.

Illustration at top, reproduced from "The History of All Nations," shows ancient Egyptian shipbuilding as depicted on the tomb of Ti, at Sakkara. In contrast is the 55' regenerator being built by Sun.

Sun

SHIPBUILDING & DRY DOCK COMPANY

SINCE 1916

ON THE DELAWARE • CHESTER, PA.

25 BROADWAY · NEW YORK CITY

Tanks of the General American Transportation Corporation's Storage Terminal, Carteret, N. J., after being painted with Light Gray TANKHIDE.

IF IT'S TOUGHNESS AND LONG LIFE YOU WANT—USE PITTSBURGH TANKHIDE

WHEN you're looking for toughness and durability in a finish for gasoline and oil storage tanks, Pittsburgh TANKHIDE gives you what you want.

● **The combination** of special pigments and weather-resistant vehicles makes TANKHIDE an unusually durable, long-lasting metal protective paint. The ability of TANKHIDE to reflect heat prevents excessive losses caused by evaporation. Not only are evaporation losses prevented but TANKHIDE'S original appearance is maintained for a long time by its unique self-cleaning action.

● **TANKHIDE** is designed to hide thoroughly with one coat, whether sprayed or brushed on.

● **For many years TANKHIDE** primers and finishing coats have been used most satisfactorily in all sections of the country to protect millions of tons of iron and steel in structures, equipment and machinery.

● **Besides TANKHIDE,** Pittsburgh also offers a complete line of protective coatings for every need in the petroleum industry—production and refinery finishes for towers, pipe lines, buildings and equipment; service and bulk station paints; pump enamels and drum finishes.

● **Call on us** for expert advisory service. Our wide experience in supplying finishes to the petroleum industry can be helpful and often save you time and money.

• • •

PITTSBURGH PLATE GLASS COMPANY

Industrial Paint Division, Pittsburgh, Pa.
Factories: Milwaukee, Wis.; Newark, N. J.; Springdale, Pa.; Houston, Texas; Los Angeles, Calif.; Portland, Ore. Ditzler Color Division, Detroit, Mich. The Thresher Paint & Varnish Co., Dayton, Ohio. Forbes Finishes Division, Cleveland, Ohio. M. B. Suydam Division, Pittsburgh, Pa.

PITTSBURGH PAINTS

PAINTS • GLASS • CHEMICALS • BRUSHES • PLASTICS

PITTSBURGH PLATE GLASS COMPANY

Here's what WE mean by

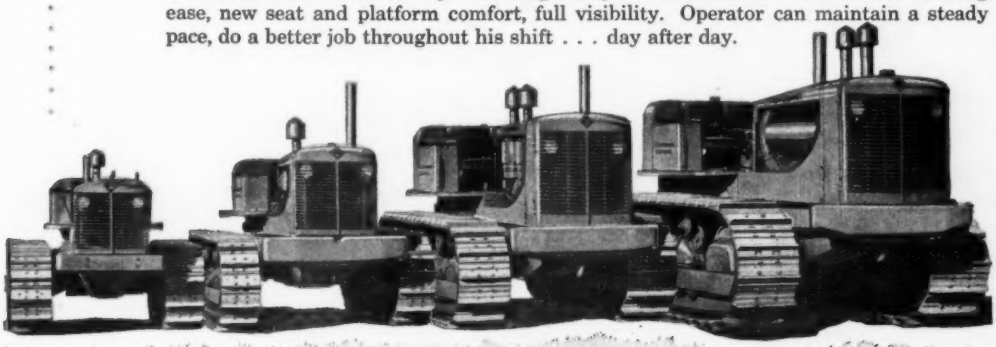
The Newest, Finest Tractor Line on Earth!

DESIGNED FOR YOUR JOB These Allis-Chalmers tractors are *new from the ground up* . . . without compromise anywhere in design or material. They are built to give you outstanding performance on any job, with any equipment—drawn or mounted. Fully matched line of Allied equipment!

BUILT TO "TAKE IT" These are the finest tractors ever built . . . with ample capacity and strength in every part! You can depend on them to take the loads and jolts of today's jobs . . . because they are modern tractors built for the most gruelling operating conditions. They will more than measure up to your expectations!

EASY TO SERVICE Adjustments are easier . . . lubrication simplified and lube periods greatly extended. Mechanics say these tractors are the easiest to service and repair. This all adds up to less down time, more producing time . . . longer tractor life at less upkeep cost.

EASY TO OPERATE Conveniently located controls respond to the slightest effort . . . and are operated in the same familiar way — nothing tricky to "catch on to." There is new shifting ease, new seat and platform comfort, full visibility. Operator can maintain a steady pace, do a better job throughout his shift . . . day after day.



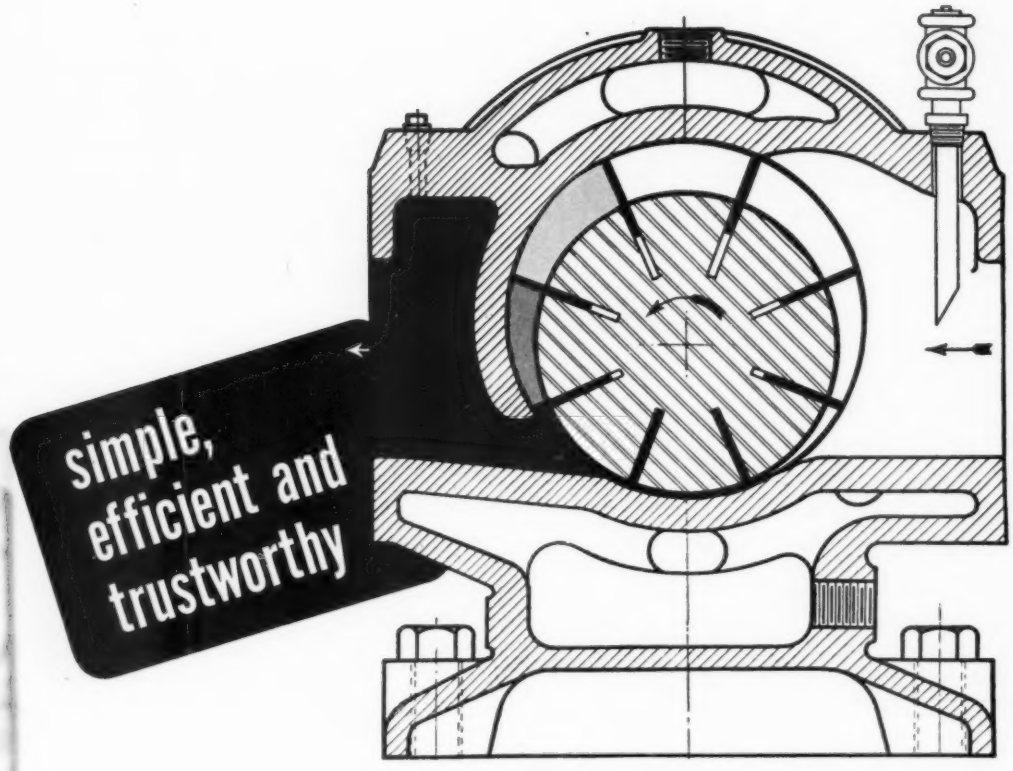
HD-5	HD-9	HD-15	HD-20
40.26 drawbar hp.	72 drawbar hp.	109 drawbar hp.	Hydraulic Torque Converter Drive
11,250 lb.	18,800 lb.	27,850 lb.	175 net engine hp. 41,000 lb.

YEARS AHEAD

Each of these new Allis-Chalmers crawlers gives you a new yardstick for rating tractors. Each sets new standards in its class for performance, strength, servicing, operation. Get the full story from your Allis-Chalmers dealer NOW on this—The Newest, Finest Tractor Line On Earth.

ALLIS-CHALMERS

TRACTOR DIVISION — MILWAUKEE 1, U. S. A.



the FULLER ROTARY COMPRESSOR

For compressing gas, no reciprocating compressor can compare in simplicity and operation with a rotary.

PRINCIPLE IS SIMPLE

An eccentrically mounted, accurately machined rotor, with integral shaft, is supported on roller bearings in each of the heads. The eccentric rotor mounting leaves a crescent-shaped space, which is divided into compartments by wear-compensating blades. These slide freely in milled slots in the rotor, and are held, pressure tight, against the cylinder solely by centrifugal force. These compartments vary from minimum to maximum on the suction side, and from maximum to minimum on the compression half of the revolution. Properly designed blades, and a wide seal between rotor and bottom of cylinder, assure high and **maintained** volumetric efficiency; the multiple blades minimize pressure differences between compartments and contribute to maximum output with minimum wear.

OPERATION IS EFFICIENT

The Fuller Rotary Compressor assures a smooth flow, with no pulsations ... numerous displacement deliveries per revolution as against one in a single-cylinder piston compressor. Other advantages are: Direct drive; Compact installation; Simple foundations; Maintained capacity and efficiency; and No valves to leak. Because there are few moving parts —rotor, blades, and bearings, **maintenance time and costs are negligible.**

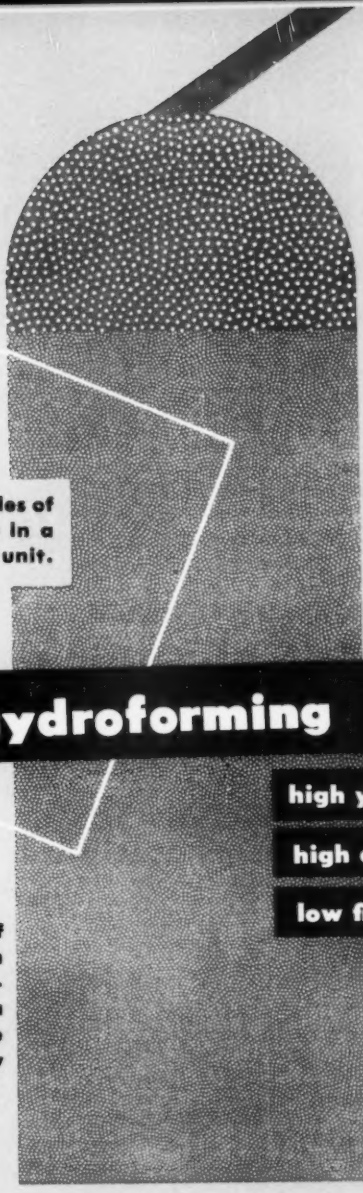
For further information on Fuller Rotary Compressors that will do a better job for you, write for Bulletin C-5.

Fuller

DRY MATERIAL CONVEYING SYSTEMS
AND COOLERS • COMPRESSORS AND VACUUM PUMPS
FEEDERS AND ASSOCIATED EQUIPMENT

FULLER COMPANY
Catasauqua, Pennsylvania
Chicago 3—120 So. LaSalle St.
San Francisco 4—420 Chancery Bldg.

C-218



10,000 square miles of catalyst surface in a 10,000 bbl/day unit.

fluid hydroforming

high yield

high octane

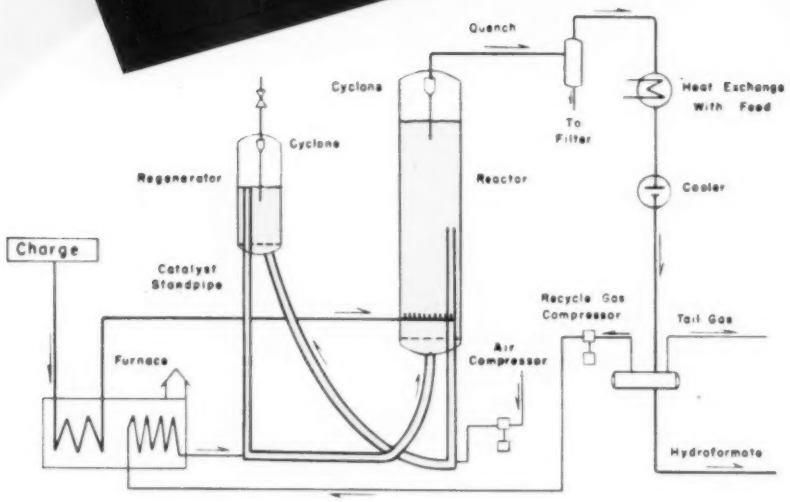
low first cost

It is this great quantity of active catalytic surface in an extremely turbulent "fluidized" state that produces a high yield . . . of high octane gasoline . . . and . . . at a low first cost.

FOSTER WHEELER CORPORATION

165 BROADWAY, NEW YORK 6, NEW YORK

fluid hydroforming



The "fluid" principle, as applied to hydroforming, provides all the distinct advantages of full, continuous operation. Its inherent process variables also makes possible a more exact control of the intensity of the hydroforming reaction.

Foster Wheeler's Fluid Hydroforming Pilot Plant is available for stock evaluation and determination of process design data.

FOSTER WHEELER CORPORATION

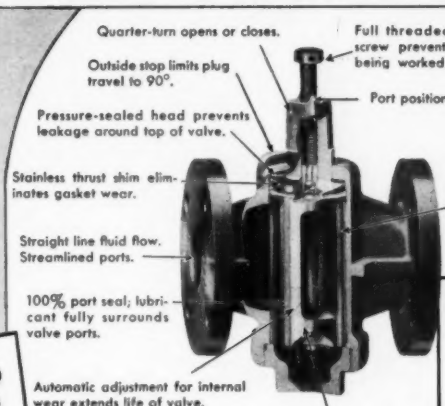
165 BROADWAY, NEW YORK 6, NEW YORK

We Make ALL Types of PLUG VALVES

ONE OF THEM IS THE RIGHT VALVE FOR YOUR NEEDS

HOMESTEAD-REISER
"Self-Seald" LUBRICATED PLUG VALVES

Straight-way—
Worm & Gear Operated


Quarter-turn opens or closes.
Full threaded lubricant screw prevents dirt from being worked into valve.
Outside stop limits plug travel to 90°.
Port position indicator.
Pressure-sealed head prevents leakage around top of valve.
Stainless thrust shim eliminates gasket wear.
Self-Seald — Wedge action of divided plug gives extra tight seal against leakage.
Straight line fluid flow. Streamlined ports.
100% port seal; lubricant fully surrounds valve ports.
Automatic adjustment for internal wear extends life of valve.
Sealing surfaces protected from corrosive or erosive line fluids.

Flow Changer—
Non-lubricated

HOMESTEAD CAM-SEALD
(dry seat)

HOMESTEAD LEVER-SEALD
(quarter turn)

How the Amazing "Self-Seald" Principle Works

Homestead-Reiser's patented "Self-Seald" principle is, we believe, the simplest and most effective sealing principle yet developed for lubricated plug valves.

In addition to a full lubricant seal around the ports, and around the top and bottom of the valve, the wedge-action of the divided plug under line pressure, causes the finely-finished surfaces of both segments of the plug to press outward against the sealing surfaces of the body.

This self-sealing action keeps the plug surfaces in contact with the mirror-like bore of the body. The plug automatically adjusts itself for wear, thus assuring extra long life and maximum leakless service.

For complete information, sizes and prices, write for Catalog 39-S. No obligation.

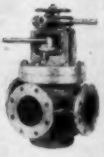
Straight-way—
Flanged or Screw Ends

Straight-way—
Flanged or Screw Ends

Three-way—
Screw or Flanged Ends

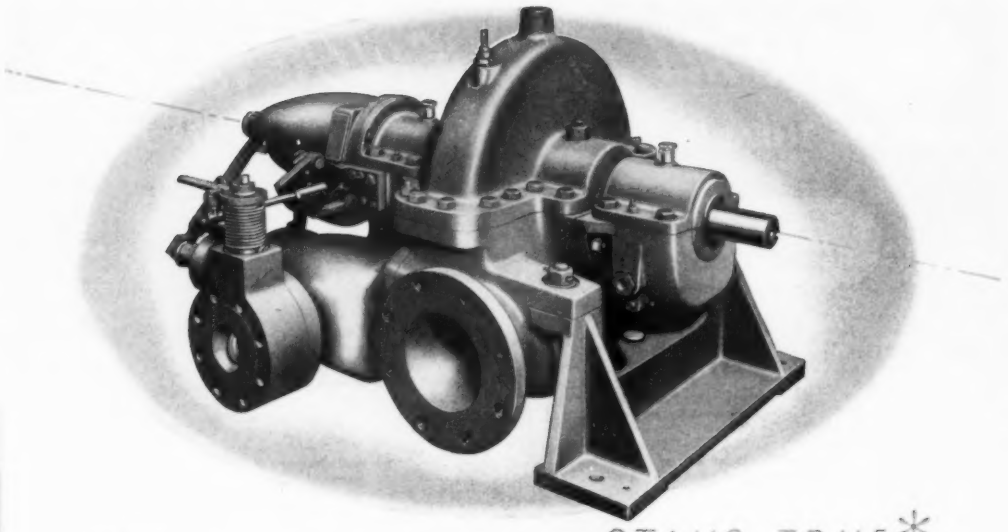
Four-way—
Flanged or Screw Ends

Four-way— Flanged or Screw Ends



Three-way— Flanged or Screw Ends

HOMESTEAD VALVE MANUFACTURING COMPANY
P. O. BOX 403 *"Serving Since 1892"* **CORAOPOLIS, PA.**



Alignment that *STAYS TRUE** when the heat's on!

Three-Way Centerline Support

* The Type E method of support allows three-way freedom of expansion and contraction without disturbing the alignment of the rotor shaft. The governor end is mounted on a strong but flexible channel beam to permit axial expansion. At the shaft-coupling end, a unique keyed support connects to the turbine near the shaft centerline to permit lateral expansion; and a vertical kingpin transmits thrust from the expanding steam pipes directly to the foundation and not to the turbine. The casing is free to move vertically with expansion or contraction.

Heat expansion can't disturb Type E alignment. The operation of driven equipment is easier, more dependable—installation costs are reduced. Westinghouse unique *three-way centerline support* keeps alignment perfect with the driven machine. Strong supports at both the governor and exhaust ends are supplemented by a vertical kingpin that transmits lateral thrust to the foundation. Hot or cold—for constant operation or instant stand-by power, you can depend on the Type E Turbine to "Stay True"!

There are other cost saving advantages, too. Dual protection against overspeed, weatherproof bearing seals, corrosion-resisting gland zones, floating movement of governing and trip linkage, and parts interchangeability between wheel sizes are just a few.

For the full story ask your nearby Westinghouse Steam Specialist for the Type E Turbine Book B-3896, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-50520

YOU CAN BE SURE.. IF IT'S
Westinghouse

TYPE E Turbines

DOW ANNOUNCES

the opening of another **caustic soda terminal**

to serve you better!

now

LOS ANGELES *is also a main distribution center for*

Dow Caustic Soda

Yes, a new caustic soda solution terminal in Los Angeles to assure you of even faster and more dependable delivery! This is just another step in Dow's program to provide industry with the best possible service. Dow operates caustic soda plants in California, Texas, and Michigan. In addition to shipping from these large plants and the new terminal in Los Angeles, Dow distributes caustic soda solution from bulk tank terminals in Carteret, New Jersey, and Charleston, South Carolina. Dow also distributes caustic soda solid, flake and ground flake from terminals in Chicago, Illinois; Port Newark, New Jersey; and Charleston, South Carolina. For a constant and dependable supply of caustic soda . . . take advantage of Dow's nation-wide distribution facilities today!

wherever you are . . . *you're close to*

DOW CAUSTIC SODA

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Atlanta • Cleveland • Detroit
Chicago • St. Louis • Houston • San Francisco • Los Angeles • Seattle
Dow Chemical of Canada, Limited, Toronto, Canada

DOW
CHEMICALS
INDISPENSABLE TO INDUSTRY AND AGRICULTURE

You can believe in THIS SIGN

...it identifies your Waukesha Distributor

How well . . . and how long . . . Waukesha Engines and Power Units perform for the user of a truck, tractor, air compressor, shovel, oil rig, or any other power machinery . . . is of prime importance to the Waukesha Motor Company . . .

And the link between the two—the Waukesha Distributor, is of equal importance.

For your convenience the Waukesha Distributor in your locality has a full stock of Waukesha engineered parts. And an assortment of complete Waukesha Power Units for quick delivery . . .

Experienced mechanics, too—ready to give your Waukesha Engines periodic inspection and tune-up . . . or to rebuild your equipment when needed. Trained engine-specialists perform every service operation by factory-approved methods, and to Waukesha precision standards. The mechanical staff will be glad to give you practical technical advice on any phase of the use and care of Waukesha power plants.

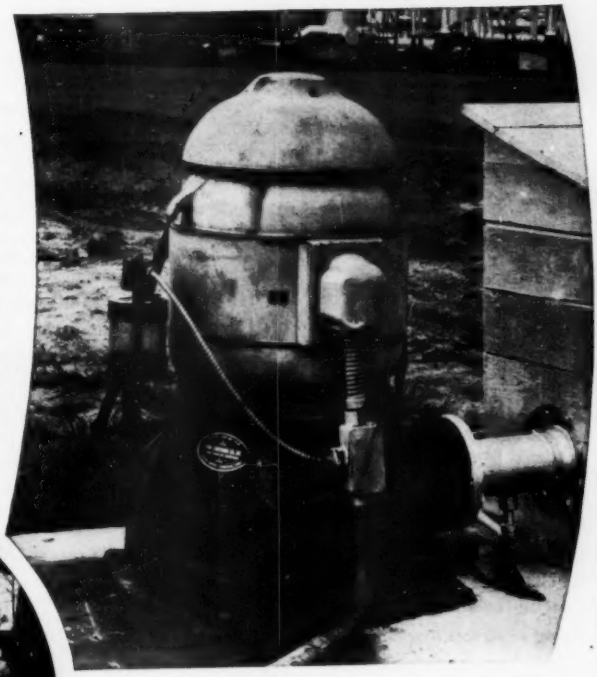
Your Waukesha Distributor is a part of a select, nationwide organization of engineers and service men of specialized experience and the highest reputation. He's a good man to know . . . and you'll like him, too. Look for the sign—stop in and see him. 146

WAUKESHA MOTOR COMPANY, WAUKESHA, WIS.
NEW YORK • TULSA • LOS ANGELES

The right combination

FOR ANY WATER SUPPLY JOB

Layne offers you the right combination of unmatched experience plus modern equipment for installing well water supply units of any size—and for any purpose. Layne has made more water supply installations than any other firm in the entire world, and this valuable experience places Layne in a position to unquestionably do every job exactly right. Once the installations have been made, a complete record of everything is kept; strata formation, sand porosity, casing details, sand screen length, diameter and metal used, all pump information including bearings, shafting, impellers and operating characteristics. With such information, Layne is always in a position to give quick and most economical service for adjustments or repairs if and when needed.



Layne made the above well and pump installation to secure a constant and economical supply of cooling water for a large gasoline refinery.

When completed the above pictured well flowed more than 2 feet above the casing. With the installation of a Layne pump, the production was 1200 G.P.M.

Everything by Layne

Layne accepts your contract for furnishing everything; Layne supervision, Layne drill crews, Layne drill equipment, Layne designed and Layne built louver type sand screen and Layne high efficiency vertical turbine pumps. No other firm is involved, therefore there is no divided responsibility. This plan gives you the very finest well water supply units that world wide experience and skill can possibly build.

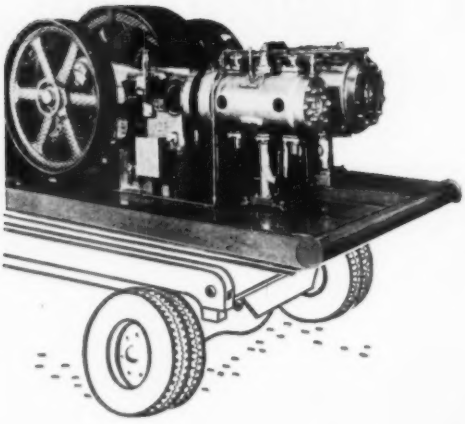
LAYNE & BOWLER, INC.

General Offices, Memphis 8, Tenn.

LAYNE CATALOGS

Layne offers a wide range of fully illustrated catalogs covering every phase of well water installations, pumps, well cementing and sand screens. Your request for any will be answered promptly.

Layne
WATER SUPPLY
WELLS & PUMPS



Truck 'em in and Hook 'em up!

Gardner-Denver Booster Compressors are compact, skid-mounted units — built within road limits for fast trucking to location.

They're completely assembled units — ready to hook up and go — are easily disconnected and moved as your field conditions change.

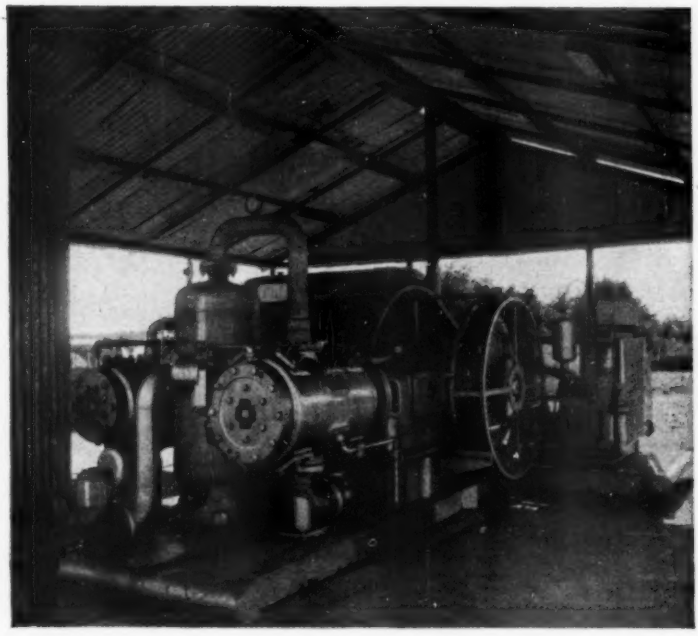
Install them anywhere in the field — wherever you need a continuous and dependable compressor unit. Famous Gardner-Denver quality features — plus automatic safety controls — assure full load service — day and night — without pampering.

A Size to Meet Your Needs . . .

Complete Gardner-Denver compressor units are available in a wide range of capacities and pressures for booster service, re-pressuring or air-gas lift. Single-stage or two-stage outfits can be furnished with any type of drive, in sizes from 5 to 275 h.p.

Write us for complete details, or call your nearest Gardner-Denver office for expert help in choosing the correct outfit for your field conditions.

Gardner-Denver 8 & 4¼ x 11 RX Two-Stage Booster Compressor



Since 1859

GARDNER-DENVER

THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS

Gardner-Denver Company, Quincy, Illinois

Dallas • Houston • Tulsa • St. Louis • Los Angeles • San Francisco
New York • Chicago • Pittsburgh • Denver • New Orleans
Continental Supply Co., Continental Bldg., Dallas, Texas
Export Division: 30 Rockefeller Plaza, New York, N. Y.
Republic Supply Co. (of Calif.), 2600 S. Eastland Ave., Los Angeles, Calif.

Choosing tower packing for efficiency and long life...

With critical shortages imminent in almost every heavy industry, the question of what tower packing material to use warrants the most careful forethought.

To the requirement of optimum performance now must be added *durability* . . . replacements may be hard to make in the years ahead.

The various tower packing forms developed from Nickel, Inconel® and Monel® deserve your special consideration. All three metals possess high strength, wettability, and high resistance to attack by many fluids processed in packed towers.

Metal tower packing offers five basic advantages that serve to increase tower efficiency:

1. **Low weight per unit volume.**
2. **Large surface per unit volume.**
3. **Large percentage of open area.**
4. **Small weight of liquid retained.**
5. **Corrosion resistance.**

If you need help in selecting a satisfactory metal tower packing material, Inco's Technical Service Department will gladly make recommendations. Simply write, outlining your problems.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

EMBLEM OF SERVICE
NICKEL INCO ALLOYS

MONEL® • "R"® MONEL • "K"® MONEL • "KR"® MONEL • "S"® MONEL
NICKEL • LOW CARBON NICKEL • DURANICKEL®
INCONEL® • INCONEL "X"®

Berl saddle type tower packing, produced in Inco Nickel Alloys and other metals, supplied by Wire Cloth Products, Inc., Chicago, Ill. Packing of this type has given excellent results in pilot towers. It compares favorably in cost with other forms of packing.

★ ★ ★

ABOUT DELIVERIES . . .

Today, Nickel and Nickel Alloys are on "extended delivery" because so much is needed for defense. Although the Government has, in fact, forbidden use of the metals for certain applications, many of their essential uses in your industry are still permitted.

By ordering well in advance of your actual needs, you'll improve your chances of getting delivery for the time the material is needed.

Be sure to include C.M.P. ratings and, where possible, contract numbers for Dept. of Defense orders.

★ ★ ★

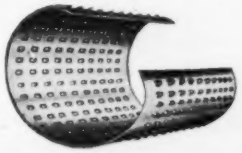


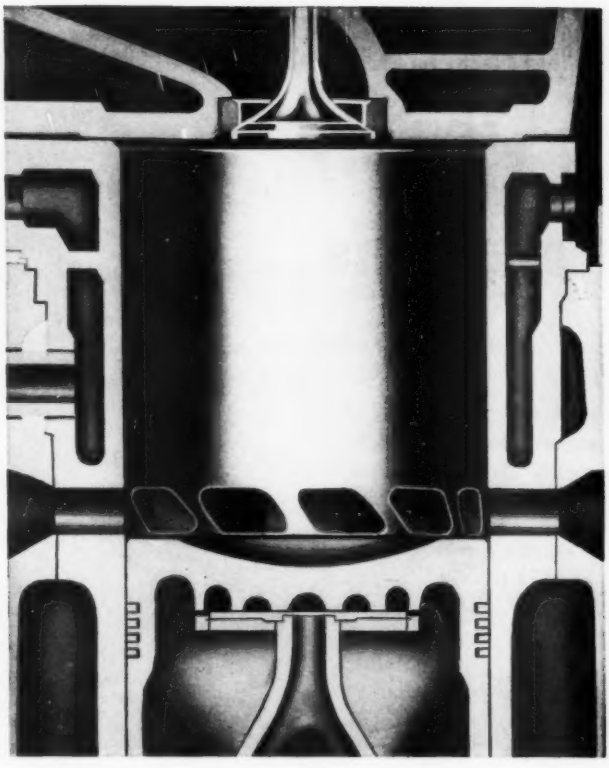
Diagram of protruded packing made by Scientific Development Company, State College, Pa. The individual pieces are small, yet have a large free cross-section. Made in Nickel, Type 316 Stainless Steel, and other metals (on special order).

Heart of a fractional liquid extraction unit comprising a mixing and settling section. The settling section is packed with knit Monel wire mesh. With knit tower packing, open areas from 90% to 98% are obtained, with surface areas up to 200 square feet per cubic foot of packing. Courtesy Otto H. York Co., Inc., East Orange, N. J.

Nearly three tons of Raschig rings, ready for shipment to a large chemical manufacturer. Made of Nickel strip 1½ inches wide by 0.050 inches thick, by the Metallo Gasket Company, New Brunswick, N. J.

IT'S THE

Biggest News in Gas-Engine Compressors



The *vital power center*

that cuts down-time and increases efficiency in many gas and petroleum-processing services

For the first time, a vastly superior type of scavenging has been applied to compressor engines.

Worthington's timed scavenging system, built into the uniflo UTC-16, gives advantages far beyond any previous method.

A Thoroughgoing "Clean Sweep"

Here are some of the features of this new system concentrated in the "vital power center" illustrated above:

Complete removal of exhaust gas . . . more thorough charging with gas and air . . . positive timing for optimum combustion . . . effective supercharging . . . low operating temperature preventing carbonization . . . uniform cylinder temperature resulting in equal wall stress eliminating harmful stresses.

Many Uses . . . Many Sizes

While designed primarily as a pipeline gas-engine compressor, the UTC-16 is suitable for many other services, including: pressure maintenance on oil wells . . . in natural gasoline plants . . . in oil refineries, for solvent extraction, vapor recovery, recycling and stabilization of gases . . . in petrochemical processing of products made from natural gas under pressure . . . in many refrigeration applications.

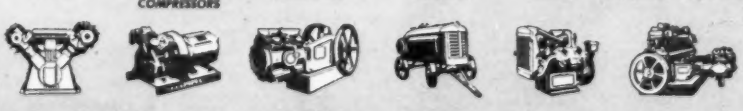
The Uniflo UTC-16 is built in sizes ranging from 800 to 2000 hp. For further proof that *there's more worth in Worthington*, contact our nearest Branch Office, or write the Worthington Pump and Machinery Corporation, Engine Division, Buffalo, N.Y.

WORTHINGTON

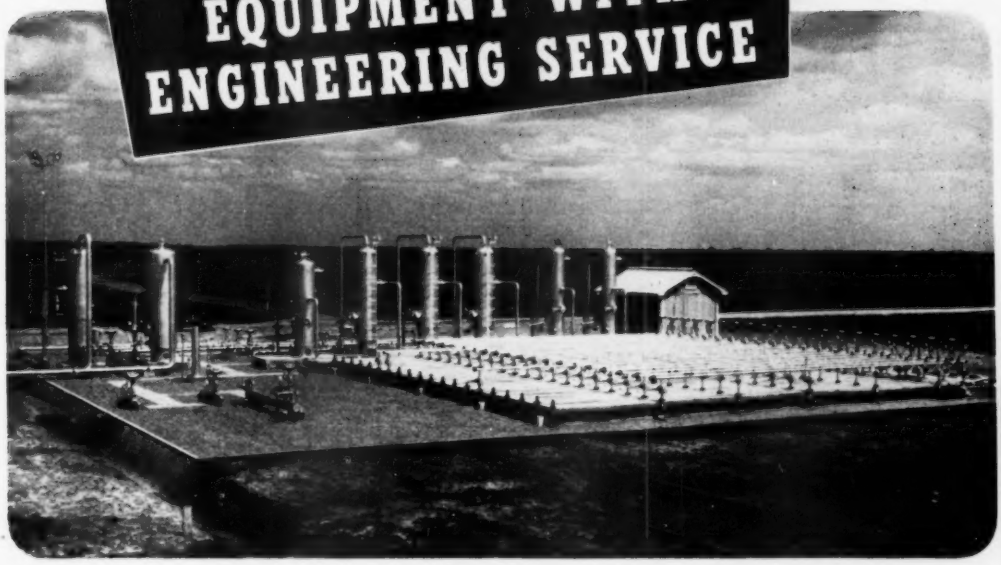
ENGINE COMPRESSORS

EK.1.2

NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON



EQUIPMENT WITH ENGINEERING SERVICE



This is the largest of a new type of field installation for the conservation of natural gas, furnished by Maintenance Engineering Corporation. It is a completely unitized and automatic system for pressure maintenance of oil reservoirs.

COMMERCIAL
Orifice Fitting

HAGAN
Ring Balance Meter

MASONEILAN
Control Valve

MASONEILAN
Pressure Controller

PEERLESS
Injection Well Separator

SMITH
Positive Displacement
Oil Meter

MAINTENANCE
ENGINEERING CORPORATION
3611 CLINTON DRIVE
P. O. BOX 2637
HOUSTON 1, TEXAS
L D 409 PR 3135

MECO

P&H DIESEL ENGINES

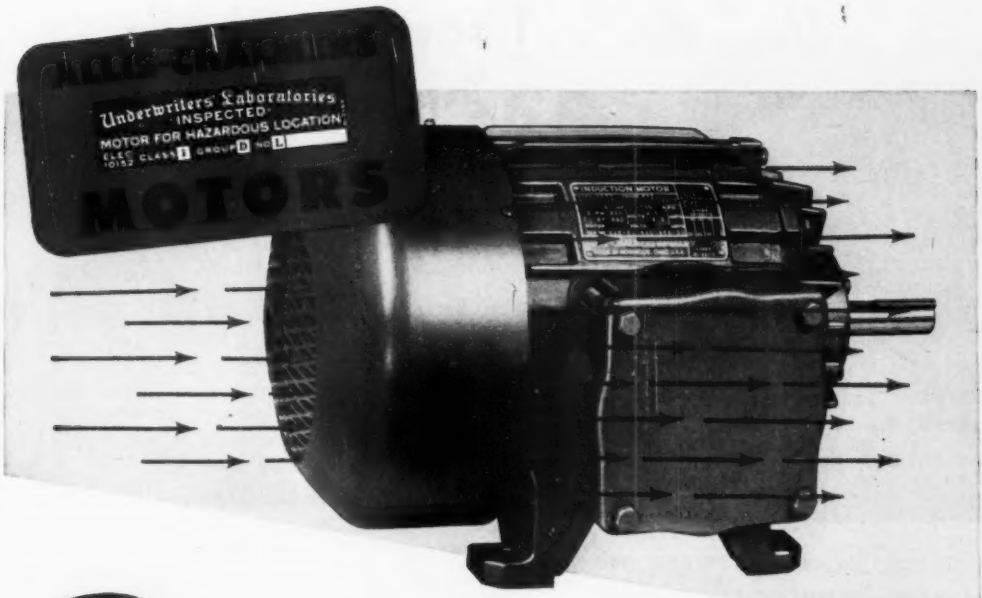
2-CYCLE

MINUTES...NOT HOURS!

REPLACE THIS COMPLETE CYLINDER ASSEMBLY

Here's something you can't do with any other diesel. The P&H cylinder assembly (comprising head, liner, piston and rod) fits *any* P&H Model — 1, 2, 3, 4 or 6-cyl. It's built as a unit; stocked as a unit; installed as a unit — anywhere — in minutes . . . not hours or days! Think what this can mean to you in time and money saved. No wonder more and more diesel users are standardizing on P&H Diesels. For literature, write Diesel Division, Harnischfeger Corporation, Crystal Lake, Illinois.

P&H DIESEL DIVISION
HARNISCHFEGER CORPORATION
CRYSTAL LAKE ILLINOIS, U.S.A.



Blows itself clean as a Whistle!

DIRT IS CARRIED AWAY by cooling air blown over the ribbed cast iron frame and bearing housings of this new Allis-Chalmers explosion proof motor. That means less motor cleaning . . . inspection . . . overhaul!

Concealed air passages and pockets have been eliminated. Dirt can't build up to cause overheating. And as for oily dirt, that sticks — just wipe or blow it off.

This means savings. This new Allis-Chalmers Type APZZ explosion proof motor makes maintenance costs lower than ever before.

Rigid Construction

The frame is cast iron which has high resistance against corrosion and distortion. Bearings are pre-lubricated at the factory and should need no attention for years. Tapped holes with pipe plugs to permit regreasing and to provide grease relief are standard equipment

Get All The Facts

The new Allis-Chalmers Type APZZ explosion proof motor is built in all NEMA standard frame sizes from 224* to 505. Also built in totally-enclosed, fan-cooled type. Your nearby Allis-Chalmers Distributor or Sales Office has complete information on this new motor. Call today, or write Allis-Chalmers, Milwaukee 1, Wisconsin. Ask for Bulletin 51B7286.

A-3477

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.

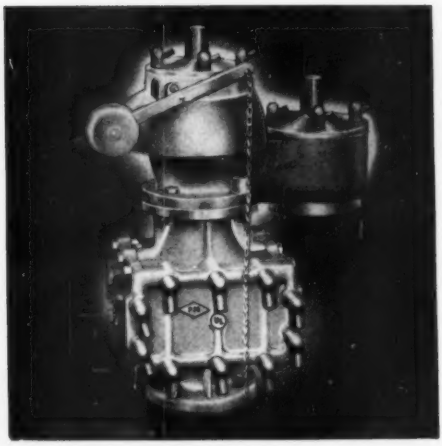
PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

Texrope and *Vari-Pitch* are Allis-Chalmers trademarks.

ALLIS-CHALMERS

*Similar design non-ventilated motors Type APKK also available in frames 203 to 224 inclusive.

Here's the . . . 1 FOR THE MONEY
2 FOR THE FLOW . . .

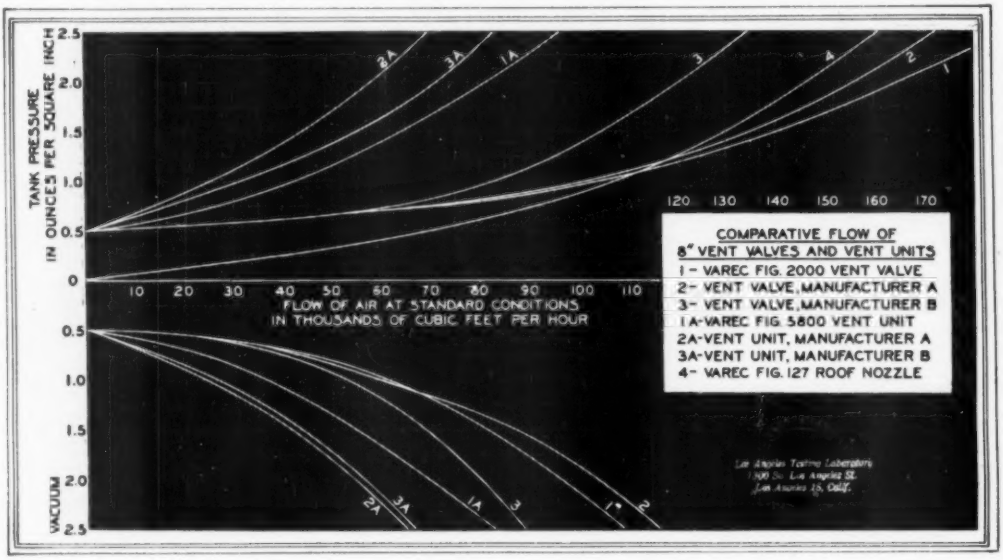


"VAREC" Figure No. 5800A Conservation Vent Unit shown above consists of Fig. No. 2000A Vent-Valve and Figure No. 50 Flame Arrester.

Certified flow curves (by an independent testing laboratory) are available for all sizes of "VAREC" Vent Valves and Units. Compare these and you'll specify "VAREC" Tank Venting Equipment on your tanks for top-flight economy, safety and trouble-free service.

Vent valve flow capacity comparison is a vital point to consider because it so often results in an initial equipment cost saving and in addition affords maximum protection for your tanks. "VAREC" Figure No. 2000 Series Vent Valves and Figure No. 5800 Series Vent Units welcome comparison because they exclusively incorporate a flow path designed comparable to a high gas velocity turbine nozzle. As a result, this "VAREC" Equipment when nipple mounted, flows even more than the nipple could theoretically flow alone!

"VAREC" Figure No. 50 Flame Arresters, governing the flow through these vent units, incorporate the largest net free area and allow maximum flow with adequate safety against flame propagation. Compare flow and cut venting costs with "VAREC".


TANK PRESSURE IN OUNCES PER SQUARE INCH
2.5
2.0
1.5
1.0
0.5
0
10 20 30 40 50 60 70 80 90 100 110
120 130 140 150 160 170
FLOW OF AIR AT STANDARD CONDITIONS IN THOUSANDS OF CUBIC FEET PER HOUR
VACUUM
2A 3A 1A 3 4 2 1
COMPARATIVE FLOW OF 8" VENT VALVES AND VENT UNITS
1 - VAREC FIG. 2000 VENT VALVE
2 - VENT VALVE, MANUFACTURER A
3 - VENT VALVE, MANUFACTURER B
1A - VAREC FIG. 5800 VENT UNIT
2A - VENT UNIT, MANUFACTURER A
3A - VENT UNIT, MANUFACTURER B
4 - VAREC FIG. 127 ROOF NOZZLE
Los Angeles Testing Laboratory
1500 So. Los Angeles St.
Los Angeles 15, Calif.

Just out, Tank Venting Equipment Bulletin. Write today for "VAREC" CP-2001 Catalog.

THE VAPOR RECOVERY SYSTEMS COMPANY
COMPTON, CALIFORNIA, U. S. A.

Cable Address: VAREC COMPTON USA (All Codes)

New York — Boston — Pittsburgh — Chicago — Detroit — St. Louis — Houston
Tulsa — Casper, Wyo. — Provo, Utah — Los Angeles — San Francisco — Seattle

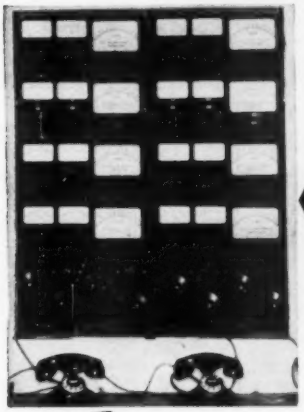
P-19

PROVED and APPROVED "Varec"

ELECTRONIC TANK GAUGING

Explosion proof design for high and low pressure tanks

Explosion proof, multi-tank, gives INSTANTANEOUS, *continuous gauge of selected tank*



Multi-tank gives simultaneous, continuous gauge of all tanks. High and low level alarms and pump or valve controls can be set to suit.

"VAREC" ELECTRONIC GAUGERS have been proved again and again in Pipeline Station and Terminal Service!

The increasing number of "Varec" Electronic Gauger installations testify to the benefits obtained from centralized gauging with proper equipment.

For example, one operator required that his laboratory maintain absolute control over products stored in all tanks and that his pump-house control the tanks being pumped. A panel of "VAREC" Figure No. 800 Receivers with high-low level alarms in the lab now permits his men to take gauge readings of any or all tanks simultaneously. If other duties require their attention, the alarm system instantly notifies them of dangerous levels. His pumpers can gauge any selected tank on the Fig. No. 813 Receiver in the pump house. Both laboratory and pump house receivers are connected to the same tank transmitters with a minimum amount of wiring to make this a practical and economical installation.

You too, can apply Electronic gauging to your oil movement and storage problems. Costs are lower than you might think.

Call in a "VAREC" representative today

PROVED and APPROVED "Varec"

THE VAPOR RECOVERY SYSTEMS COMPANY

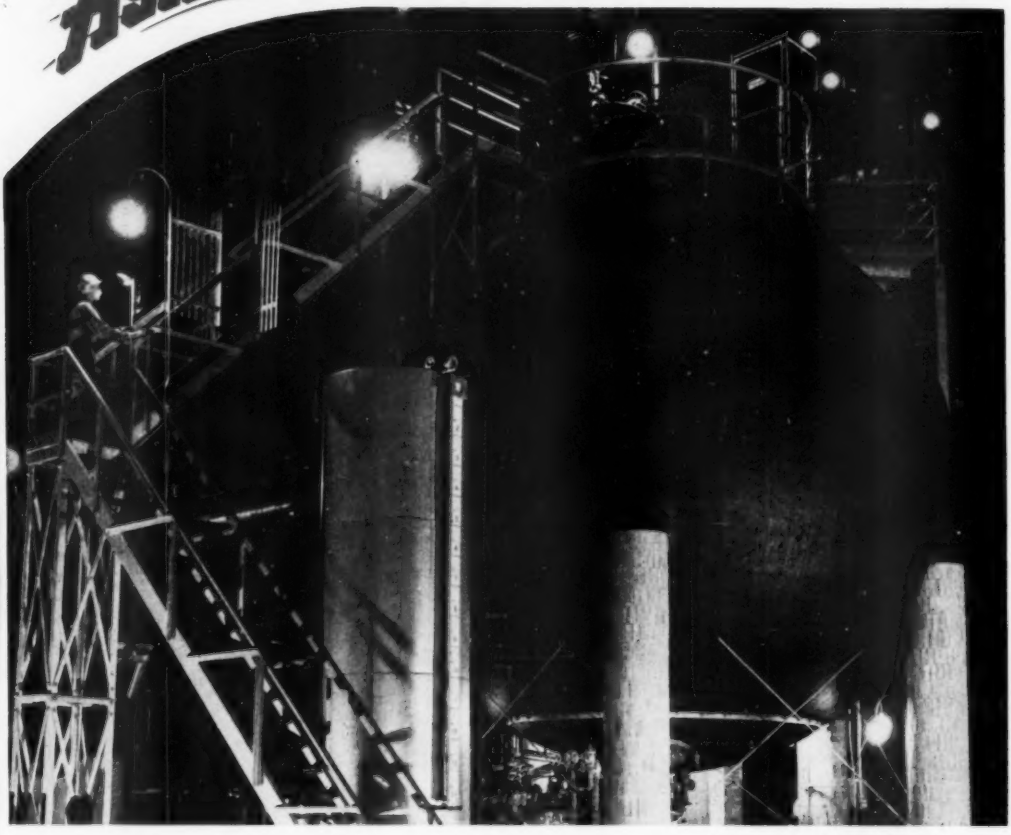
COMPTON, CALIFORNIA, U. S. A.

Cable Address: VAREC COMPTON USA (All Codes)

New York — Boston — Pittsburgh — Chicago — Detroit — St. Louis — Houston Tulsa — Casper, Wyo. — Provo, Utah — Los Angeles — San Francisco — Seattle

P-16

Ashland another leading refiner who desalts with PETRECO



The Ashland Oil and Refining Company and its affiliated companies are a fast growing and highly progressive organization. Like other leaders in the refining field, Ashland relies on Petreco Desalters to keep their crude charge free from harmful salts and solids. Like the many other experienced refiners who specify Petreco Desalting repeatedly, the Ashland group has installed Petreco in their refineries at Ashland, Kentucky; Canton, Ohio and Buffalo, New York.

Leading refiners such as the Ashland Oil and Refining Company have learned that Petreco Desalters consistently deliver high-efficiency performance, and are kept at this high performance level by helpful, dependable Petreco service engineers. **PETRECO OFFERS COMPLETE DESALTING SERVICE AND FACILITIES**

GET THE BEST IN DESALTING

Minimum residual salts and solids

Reduced furnace plugging, longer tube life

Maximum exchanger efficiency

Less corrosion in the topping section

Salvaged waste oil

Clear water bleed

Trouble-free, automatic operation

PETROLITE CORPORATION
Petreco Division
3202 So. Wayside Drive, Houston 3, Texas
1390 E. Burnett Street, Long Beach 6, Calif.

PETRECO

SPECIALIZED *Electric* PETROLEUM PROCESSES { DESALTING / DEHYDRATING

PR 51-6

spudders designed with *YOUR* drilling problems in mind

To meet the demands of drilling contractors for highly mobile cable tool drilling and servicing machines that could be transported rapidly over highways and access roads, the first Bucyrus-Erie spudder was introduced to the oil fields in 1938. Since then, these machines have built up outstanding reputations for versatile performance in field after field.

This has not happened by chance. After carefully studying field requirements to obtain a complete understanding of the problems involved, Bucyrus-Erie has worked along three major lines in developing its spudder designs. Capacity has been increased to permit working at far greater depths than ever before; much attention has been given to extending the range of jobs the machines can handle; mobility has been increased to reduce moving and set-up requirements.

When planning your future equipment purchases, look to the Bucyrus-Erie line of spudders — products of a company with 71 years of existence as a manufacturer and a background of 84 years in the development of drilling machines. Four great models — 24-L, 28-L, 36-L and 48-L; drilling depths to 6000 feet — servicing to 7000 feet. 92551

BUCYRUS ERIE

BUCYRUS-ERIE · South Milwaukee, Wisconsin

First with the *Finest* in *Spudders*

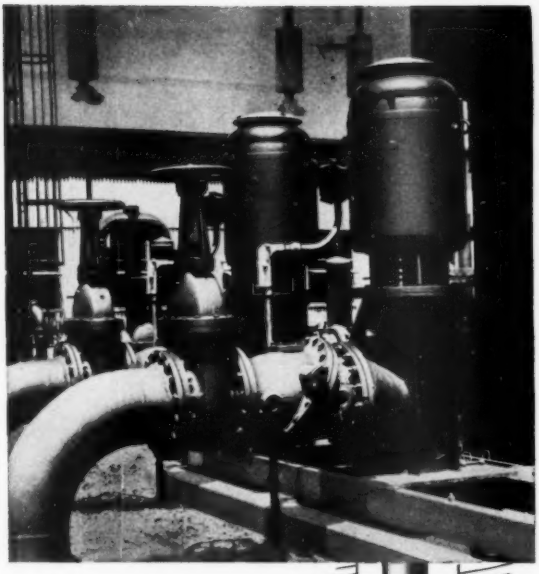
TO SAVE SPACE

TO SAVE TIME

TO SAVE MONEY

TO SAVE TROUBLE

it pays to use



I-R VERTICAL PUMPS

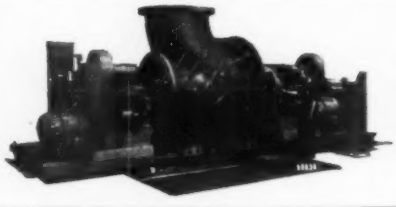
CLASS APH-APK
CLASS APM-APS

Here are a few reasons why Ingersoll-Rand wet-pit pumps have proved so successful. Their compact vertical design saves floor space—minimizes foundation requirements—reduces installation time—eliminates suction piping. Submerged suction and inherent self-priming eliminate the need for auxiliary priming equipment. There's only one stuffing box—easily accessible for inspection and maintenance. Impeller clearances can be readily adjusted from floor level by an adjusting nut at the hollow shaft motor coupling.

Class APH- and APK pumps are vertical, turbine-type units particularly applicable to cooling tower, bulk liquid transfer and dewatering services. Class APM and APS units are propeller pumps used for large capacity circulating services where high heads are not required.

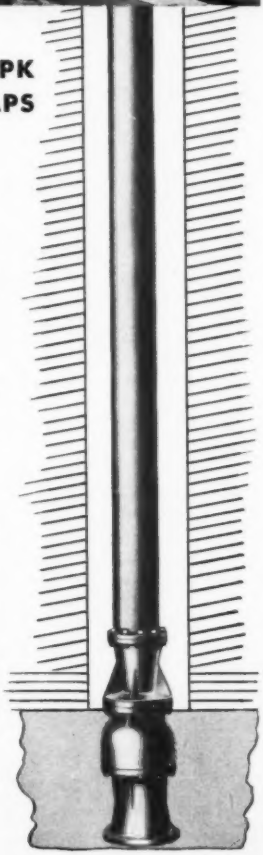
• • •

SEND FOR YOUR FREE COPY of Bulletin 7228, describing APH-APK pumps to 15,000 gpm and 250 psi, or Bulletin 7209 for APM-APS pumps to 100,000 gpm at low heads. There's no obligation, of course.



Perfect Column Alignment

This huge double-ended horizontal boring mill—the only machine of its type in use by any pump manufacturer—enables Ingersoll-Rand to achieve perfect concentricity and parallelism of all faced and flanged joints—an important factor in avoiding strain or distortion of the driving shaft on deep column pumps.



Ingersoll-Rand Cameron Division

697-10 11 Broadway, New York 4, N. Y.

CONDENSERS • PUMPS • COMPRESSORS • ROCK DRILLS • AIR & ELECTRIC TOOLS • GAS ENGINES • DIESELS

A National Banking Service

From A National Manufacturing Center

If you are interested in the billion dollar industries of oil, manufacture or distribution, transportation or construction, National Bank of Tulsa has the resources, service and facilities to finance your sound operations.

Whether you operate on the local, sectional, national or world-wide level, you will find the practical experience, intimate knowledge and affiliations of this bank of unusual value.

The Oil Bank of America

NATIONAL BANK OF TULSA

OFFERING COMPLETE BANKING AND TRUST SERVICES

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

It takes BOTH CURVES to get the full story

It's good to have someone help you find the street address you want: it helps a lot more, particularly in a big building, when someone can tell you what floor and what room to go to. Put the two together, and you know right where to go.

That's Lane-Wells Radioactivity Well Logging — the Gamma Ray to locate and define the formations for you; the Neutron Curve (which responds predominantly to the amount of fluid) to put the finger on just those sections which are worthwhile testing. Both together, they're an unbeatable combination for giving you a complete building plan for all future work.

AR-412

Tomorrow's Tools - Today!

LANE WELLS

Radioactivity

WELL LOGGING

General Offices, Export Office and Plant • 5610 So. Soto St. Los Angeles 58, California

Los Angeles • Houston • Oklahoma City
Lane-Wells Canadian Co. in Canada
Petro-Tech Service Co. in Venezuela

we can handle any job!

That's right, mister.
If it's process construction . . . we can handle it!

Procon has the broad range of experience plus the necessary flexibility to give you the advantages of a practical and efficient construction service covering all types of processing facilities.

For example, current jobs include fluid cat crackers . . . Platforming units . . . fractionators . . . vis-breakers . . . aromatic extraction units . . . gas recovery systems . . . and other types of processing units and plants.

This partial list is certainly an indication of Procon's ability to handle any type of process construction work.

PROCON *Incorporated*
PROCESS CONSTRUCTION
75 EAST JACKSON BLVD., CHICAGO 4, ILLINOIS

● Since installation of the first commercially successful cold separation assembly . . . a Parkersburg Hyreco Unit . . . scores of operators have turned to Hyreco for increasing profits from their gas wells. Today's Hyreco is better than ever. It has been improved to give you year-'round cold separation with more dependable, predictable performance during cold weather.

The greatest benefit accruing from installation of Parkersburg Hyreco is the increase in profits resulting from increased condensate recovery. By installing Hyreco Processing Units on their high pressure gas wells, operators have increased their revenue by hundreds of dollars per month . . . have increased condensate recovery by more than 5 to 15 bbls. per million feet of gas sold.

Ask your Parkersburg Representative about the Hyreco improvements that give you better cold separation than ever before. He has the facts and figures to prove what Hyreco can do for you.

No. 5121

PARKERSBURG
PRESSURE EQUIPMENT

HORIZONTAL AND VERTICAL SEPARATORS • HYRECO • HYDRACEPTER • SCRUBBERS • TREATERS • HEATERS

Manufactured in Houston, Texas

here's a complete WATER WORKS in a small package...

JBAS

for:

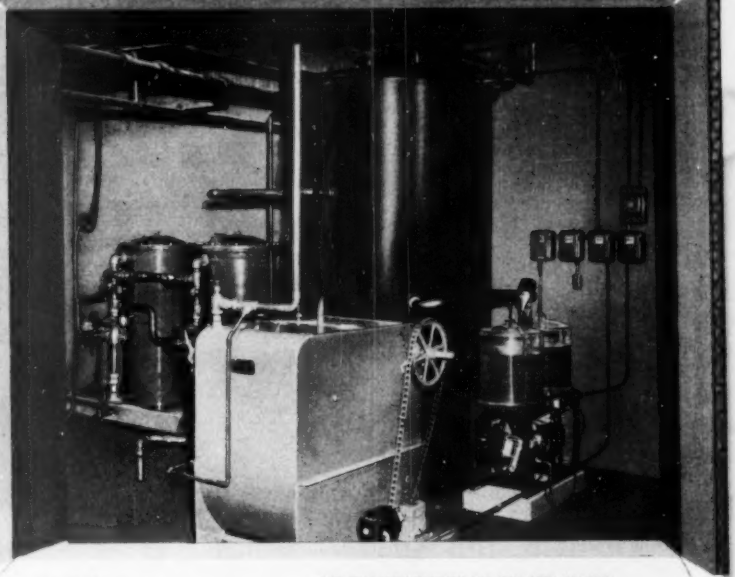
FIELD CREW DRINKING SUPPLY

ENGINE COOLING

BOILER FEED

SMALL DOMESTIC SUPPLIES

CHEMICAL AND MANUFACTURING PROCESS



FOR THE MANY USES OF TREATED WATER, INFILCO ENGINEERS THE JBAS ACCELATOR

The JBAS doesn't care if your source of water is creek, river, lake or well. It is equally effective for softening, clarifying, sterilizing, or removing organic matter, tastes, or odors. Its versatility has been demonstrated in hundreds of installations treating 5 to 100 gallons per minute, providing a water equal or superior to large municipal supplies.

Ask for Bulletin 1845

and see how a JBAS conserves space and installation costs. Learn how and why JBAS gives uniformly satisfactory results with minimum supervision and attention. Note it can be readily moved, too, if necessary.

INFILCO

* BETTER WATER CONDITIONING AND WASTE TREATMENT SINCE 1914 *

INFILCO INC. *Tucson, Arizona* | *Plants in Chicago & Joliet, Illinois*

FIELD ENGINEERING OFFICES IN 26 PRINCIPAL CITIES

World's Leading Manufacturers of Water Conditioning and Waste Treating Equipment

See PEERLESS FIRST!
For GAS SCRUBBERS...
An installation of two 48 x 19 Peerless Scrubbers, each handling 50 million cubic ft. of gas a day at 250 PSI on the inlet of a power plant in South Texas.

The *BEST SCRUBBERS* for PIPELINES, GATHERING SYSTEMS, COMPRESSOR STATIONS, PLANT INLET SCRUBBERS

With Peerless Scrubbers you can rely on Maximum Efficiency with Minimum Pressure Drop. These precision engineered scrubbers are available in both vertical and horizontal sizes or can be built to your requirements . . . For Any Gas Flow . . . For Any Working Pressure.

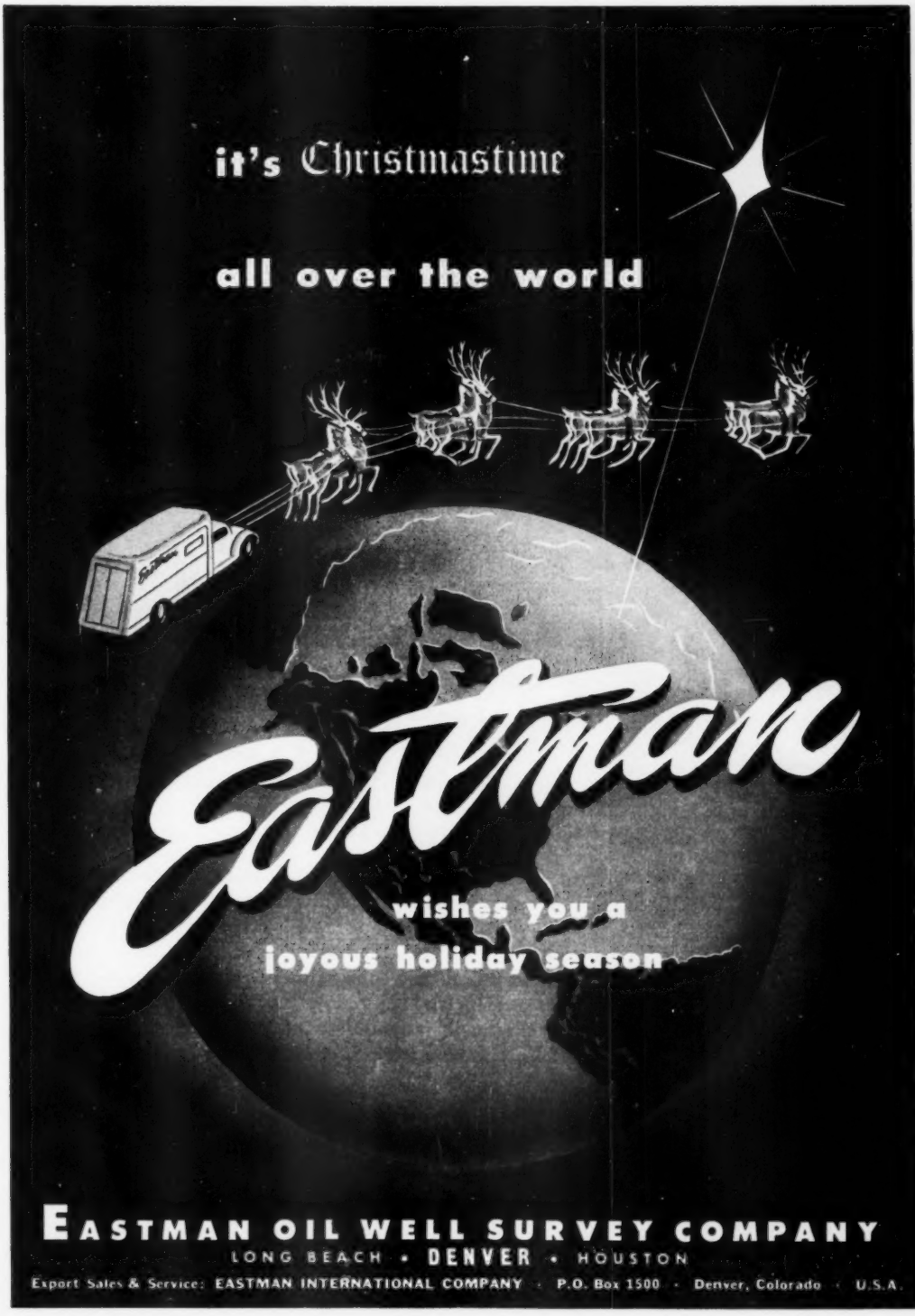
Each Peerless Scrubber is designed and built around the famous Peerless Mist Extractor Unit, which guarantees the liquid entrainment loss to be less than 1 10 gal. per million standard cubic feet of flowing gas.

PEERLESS MFG. CO.

PEERLESS MANUFACTURING CO.

P. O. BOX 7193 ★ DALLAS, TEXAS ★ DIxon-8451

REPRESENTATIVES IN ALL PRINCIPAL CITIES

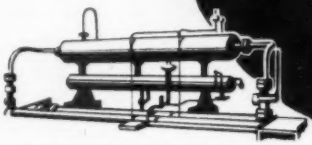

it's Christmastime
all over the world
Eastman
wishes you a
joyous holiday season
EASTMAN OIL WELL SURVEY COMPANY
LONG BEACH • DENVER • HOUSTON
Export Sales & Service: EASTMAN INTERNATIONAL COMPANY · P.O. Box 1500 · Denver, Colorado · U.S.A.

For Effective High OR Low Pressure Operation

Specify

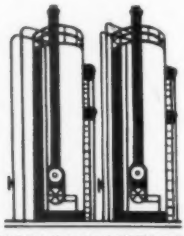
AMERICAN
NATIONAL
LINE HEATERS

OIL & GAS SEPARATORS • EMULSION TREATERS



AMERICAN-NATIONAL OIL & GAS SEPARATORS

Available in both vertical or portable horizontal models. Designed under any of several construction codes to give you improved production — and meet your specific needs.



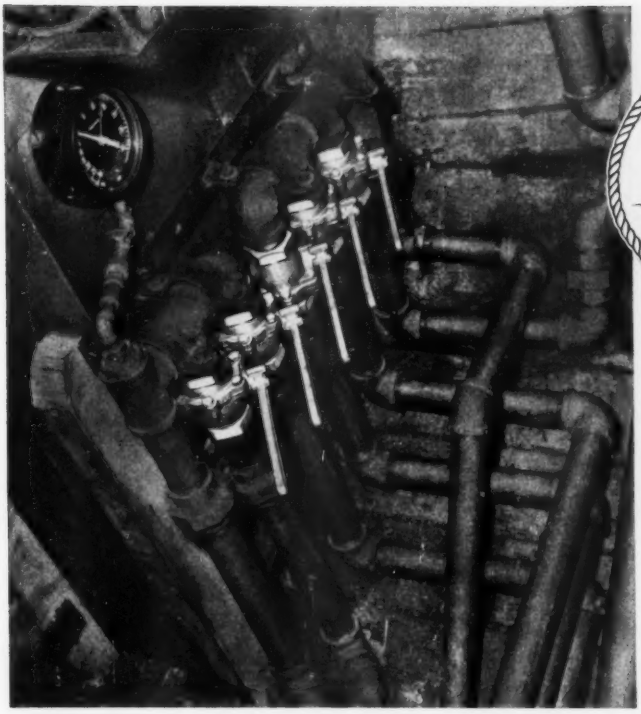
AMERICAN-NATIONAL EMULSION TREATERS

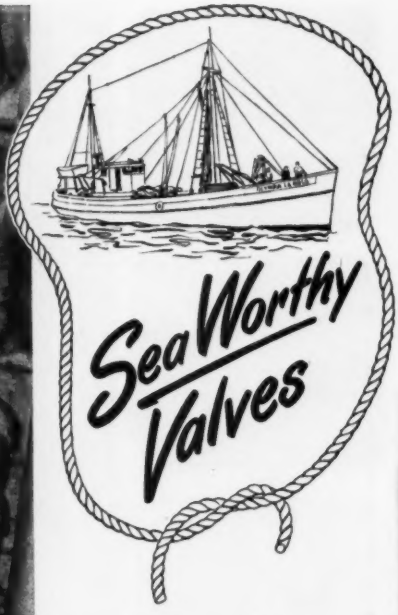
These modern treating plants are scientifically engineered for maximum capacity and continuous duty operations. Dehydrated crude reduces corrosion, increases volume in tanks, pipe lines, refining plants.

American-National Line Heaters meet your needs for either high or low pressure operation. A patented Thermosiphon Baffle gives these portable units a higher efficiency in heat transfer to the coils. This provides an even bath temperature throughout the coils of the heater. You can get a wide size range for any capacity gas or oil production. And these units are easily moved from job to job. American gives you a 100% guarantee of materials and workmanship. Contact us today.

AMERICAN
PIPE & STEEL CORPORATION

Designers • Engineers • Fabricators • Erectors
2201 West Commonwealth Avenue, Alhambra, Calif.
Cable address: AMPSTEEL
Bakersfield: U. S. Highway 99 & Casa Loma Dr.





Discharge Manifold used for quick change-over of discharge-water from two centrifugal pumps.

ROCKWOOD BALL VALVES perform perfectly against the hazards of salt water, fish scales, wood splinters, dirt, etc.

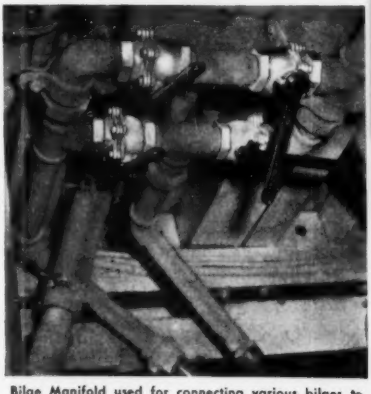
Every Rockwood Ball Valve used aboard these fishing boats has given *outstanding* service. They perform continuously without maintenance. Dirt and debris from bilges is no problem. Abrasive or corrosive mixtures pass thru valve without injury to rubber seat or ball. Quick change-over from pumping out boat to supplying wash water for deck is made easier and faster because of quick opening and closing action of valve.

Mr. C. Perkins, Engineer of Hub Machine Company, Boston, Mass., says "Rockwood Ball Valves *out-wear* and *out-perform* all other makes of valves used previously on these installations."

Thousands of Rockwood Ball Valves are at work thru-out the country speeding production, cutting maintenance cost, helping maintain high quality and making piping operations easier.

Rockwood Valves are available in bronze in pipe sizes from ½" to 2" and in cast steel from 3" to 4". They are recommended for 300 p. s. i. working pressure. Rockwood Valves are in service in oil refineries, food, paper, textiles, chemical and rubber plants.

Write for bulletin V4 — and for information regarding applications, prices, etc.



Bilge Manifold used for connecting various bilges to the pumps. Quick action is necessary because of limited time — also makes priming of centrifugal pumps easier.

Distributors in all principal cities.

ROCKWOOD

ROCKWOOD
SPRINKLER COMPANY
104 HARLOW STREET
WORCESTER 5, MASS.

Specify Whitmor!

distinctive field homes . . .

Wherever your employees are — they'll have a happier Christmas in a Whitmor Home.

"The Finest in the Field"

WHITMOR *homebuilders* Inc.

ELEVEN WEST SIXTH STREET • TULSA, OKLAHOMA

INDUSTRIAL HOUSING DIVISION OF M. W. TURNER COMPANY

RATIGAN LUBRICATING CAP FOR RATIGAN STUFFING BOXES

Provides Continual Lubrication of Polish Rod

and assures longer wear of the packing rubbers and more economical operation of the stuffing box

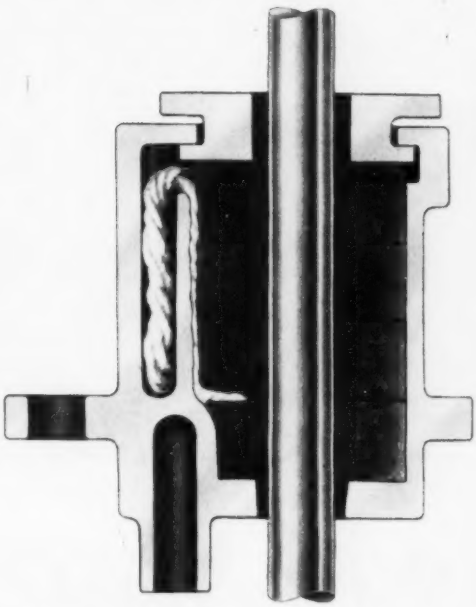
The Ratigan No. 176-1B Lubricating Cap provides the polish rod with continual lubrication by means of felt rings which are constantly supplied with oil through a wick from the oil reservoir within the cap.

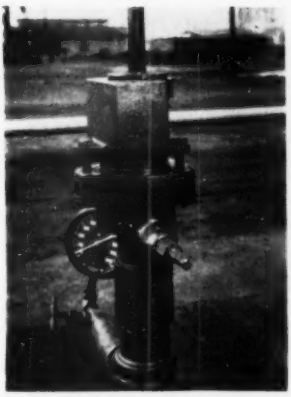
This cap is particularly adapted for oil wells that head, as the design of this cap will assure continual lubrication of the polish rod, until the regular flow of oil occurs. Although this cap is strongly recommended for heading wells, the operator will find this cap suitable for any type of pumping well.

When installing the No. 176-1B lubricating cap, the operator should saturate the felt rings with oil, place the wick in the oil reservoir and then in the felt chamber between the felts and the wall of the chamber (as shown), so that the wick contacts the four felt rings. The felts, when thoroughly saturated, will hold the equivalent of one pint of oil, while the oil reservoir will hold an additional pint of oil. This oil reservoir is filled manually by removing the cover of the cap. The pumper or utility man should check the reservoir, so that a sufficient oil supply is maintained. Felt rings will last indefinitely, unless subject to undue abuse.

The oiling system in the No. 176-1B lubricating cap is distinct from the self-oiling system in the stuffing box. The oil in the cap requires a manual filling of the reservoir, while the stuffing box reservoir has its source from the oil in the tubing. Thus we have an ideal combination, a lubricating cap which lubricates the polish rod when the flow of oil in the tubing is retarded and a self-oiling stuffing box lubricating the polish rod with oil from the well, when the well is not heading. The operator who installs a Ratigan Stuffing Box, complete with Ratigan No. 176-1B Lubricating Cap, will be assured of a reduction in operating expense.

The Ratigan No. 176-1B Lubricating Cap, complete with matching felt rings, is made for 1⅛" and 1¼" polish rod and for 1½" polish rod only. For complete information and prices, write to:





Ratigan No. 176-1B Lubricating Cap working in combination with Ratigan No. 176 Stuffing Box. Polish Rod is always protected with a fine film of lubricating oil.

J. P. RATIGAN, Inc.

1213 Santa Fe Avenue, Los Angeles 21, California
Export: National Supply Export Corporation,
600 5th Avenue, New York 20, N. Y.

Ratigan Products Are Sold Through Leading Supply Stores

This is Why the Nash is the Most Simple Compressor

It's the Nash!

There are no mechanical complications in a Nash Compressor. A single moving element, a round rotor, with shrouded blades, forming a series of buckets, revolves freely in an elliptical casing containing any low viscosity liquid. This liquid, carried with the rotor, follows the elliptical contour of the casing.

The moving liquid therefore recedes from the rotor buckets at the wide part of the ellipse, permitting the buckets to fill with gas from the stationary Inlet Ports. As the casing narrows, the liquid is forced back into the rotor buckets, compressing the gas, and delivering it through the fixed Outlet Ports.

Nash Compressors produce 75 lbs. pressure in a single stage, with capacities to 6 million cu. ft. per day in a single structure. Since compression is secured by an entirely different principle, gas pumping problems difficult with ordinary pumps are often handled easily in a Nash.

Nash simplicity means low maintenance cost, with original pump performance constant over long periods. Data on these pumps sent immediately on request

No internal wearing parts.

No valves, pistons, or vanes.

No internal lubrication.

Low maintenance cost.

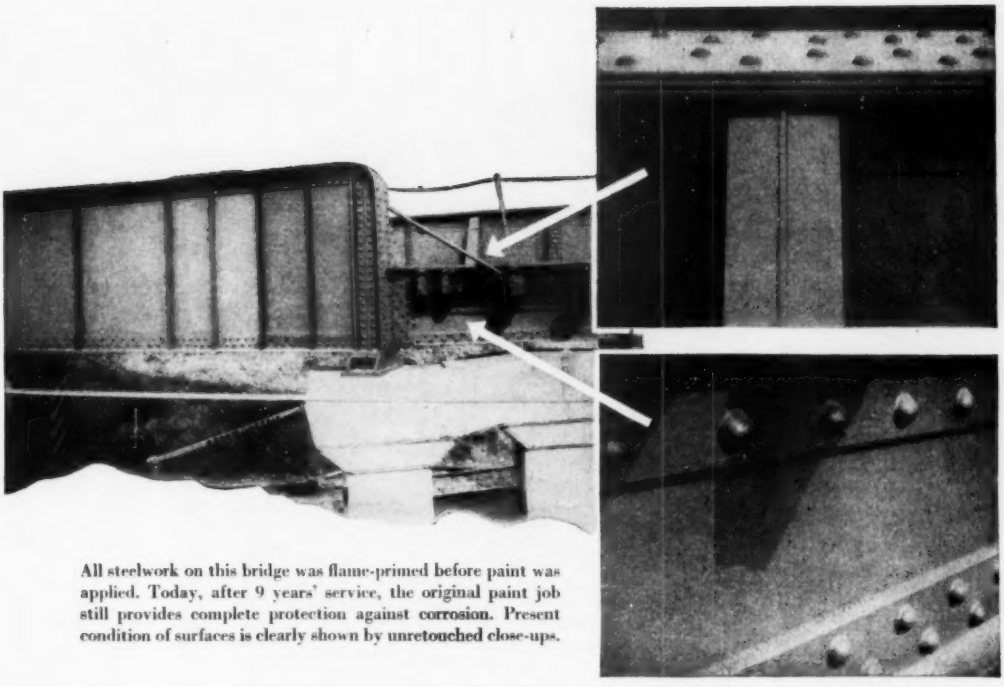
Saves floor space.

Desired delivery temperature automatically maintained.

Slugs of liquid entering pump will do no harm.

75 pounds in a single stage.

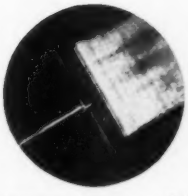
NASH ENGINEERING COMPANY
313 WILSON, SO. NORWALK, CONN.



All steelwork on this bridge was flame-primed before paint was applied. Today, after 9 years' service, the original paint job still provides complete protection against corrosion. Present condition of surfaces is clearly shown by unretouched close-ups.

Your Steelwork . . .

How Will It Look in 1960?



Steelwork you coat with good paint today can still look like new ten years from now, *if you flame-prime all exposed surfaces first.* And what you'll save on maintenance, because of increased protection due to flame-priming, will more than pay for all the flame-priming apparatus and materials you need for the job.

Flame-priming is simple to do, requires little equipment, and costs little. A brush of oxy-acetylene flames pops off scale and drives out moisture. Paint applied to the warm, dry surface goes on quickly and smoothly, bonds tightly, and lasts longer.

Flame-priming is one of many time- and money-saving LINDE methods for making, cutting, joining, treating, and forming metals. So, whatever you do with metals, there is a good chance that LINDE know-how, show-how, and equipment can help you do it better, more quickly, or at lower cost.

To find out, without obligation, telephone or write our nearest office today. LINDE AIR PRODUCTS COMPANY, a Division of Union Carbide and Carbon Corporation, 30 East 42nd Street, New York 17, N. Y. Offices in Other Principal Cities. In Canada: Dominion Oxygen Company, Limited, Toronto.

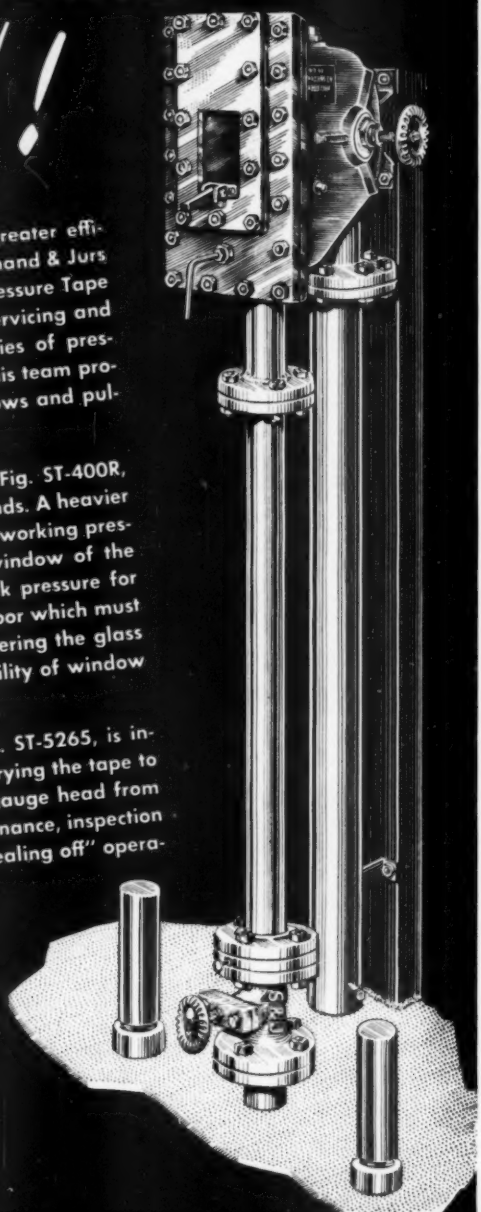
Linde
Trade-Mark

Products and Processes for MAKING, CUTTING, JOINING, TREATING, AND FORMING METALS

The term "Linde" is a registered trade-mark of Union Carbide and Carbon Corporation.

GAUGE SERVICING

Expedited!



HERE'S the ideal team for greater efficiency in gauging pressure storage tanks. It's the Shand & Jurs High Pressure Automatic Tank Gauge and High Pressure Tape Block Valve. This combination expedites gauge servicing and provides repeated gauging accuracy. On batteries of pressure storage tanks interconnected by catwalks, this team provides eye level tape reading without use of elbows and pulleys and with a minimum of piping.

The S&J High Pressure Automatic Tank Gauge, Fig. ST-400R, is designed for working pressures up to 150 pounds. A heavier model, designated Model 400PR, is suitable for working pressures up to 300 pounds. The large reading window of the gauge is retained from the inside utilizing tank pressure for tightness. The window is protected by a steel door which must be lifted for each reading, then falls back covering the glass safeguarding the tank from the remote possibility of window breakage.

The S&J High Pressure Tape Block Valve, Fig. ST-5265, is installed on the tank top ahead of the pipe carrying the tape to the gauge head. It permits isolation of the gauge head from tank pressure and vapors in the event maintenance, inspection or replacement of parts is necessary. This "sealing off" operation can be easily accomplished in a matter of seconds. The tape block valve is made for both 150 and 300 pound working pressures.

S&J

Shand and Jurs Co. 8TH AND CARLTON STREETS : BERKELEY : CALIFORNIA

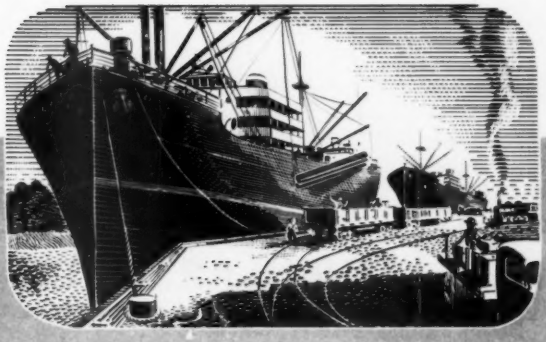
NEW YORK 295 Madison Ave. | CHICAGO 10409 S. Western Ave. | HOUSTON 827 M & M Bldg. | TULSA 310 Thompson Bldg. | LOS ANGELES 716 W. Olympic Blvd. | SEATTLE 3000 Western Ave.

MONTREAL, QUE., 360 Notre Dame St. West | VANCOUVER, B. C., 550 Beatty St. | FORT ERIE, ONT. | DARLINGTON, ENG. | CARACAS, VEN.

LUCEY is one of the very oldest names in the Supply Industry, and the firm it represents has a worldwide reputation for resourcefulness and dependability.

We have a talent for accomplishing unusual services demanding fluid policy, stability and understanding of our customer's problems that has aided substantially in the emergencies with which the Oil Industry has found itself confronted during the past several years.

LUCEY PRODUCTS CORPORATION
OIL WELL SUPPLIES
TULSA, OKLAHOMA



THE UTMOST IN ACCURACY

SOLID FRAME MICROMETER

Cat. No. 851

Precision workmanship at low cost. Available in 1" steps from 0 to 6".

TUMICO

PRECISION MEASURING INSTRUMENTS

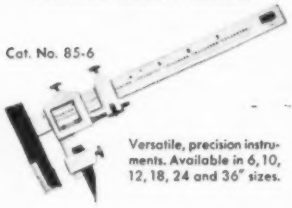
TUBULAR FRAME MICROMETER

Cat. No. T-1

Advanced structural features for lasting accuracy with 50% less weight. Available in 1" steps from 0 to 96".

VERNIER HEIGHT GAGES

Cat. No. 85-6



Versatile, precision instruments. Available in 6, 10, 12, 18, 24 and 36" sizes.

VERNIER CALIPERS

Cat. No. 75-6

Accurately measures both inside and outside diameters. Specially etched for clear reading. 6, 12, 18, 24 and 36" sizes.

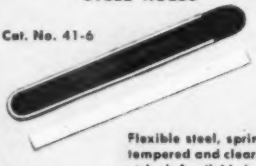
POCKET SLIDE CALIPERS

Cat. No. 90-3

Handy pocket size. Available in either high grade or stainless steel. 3 and 5" sizes.

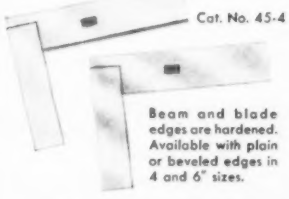
STEEL RULES

Cat. No. 41-6



Flexible steel, spring tempered and clearly etched. Available in 6 and 12" sizes.

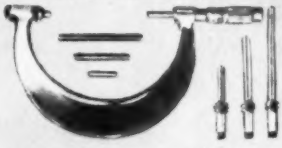
MACHINIST STEEL SQUARES



Cat. No. 45-4

Beam and blade edges are hardened. Available with plain or beveled edges in 4 and 6" sizes.

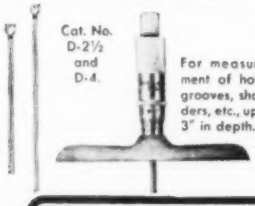
MANDREL MICROMETER



Cat. No. M

Provide wide range of precision measurement. 4 and 6" combinations from 0 to 96".

DEPTH GAGE MICROMETER



Cat. No. D-2½ and D-4.

For measurement of holes, grooves, shoulders, etc., up to 3" in depth.

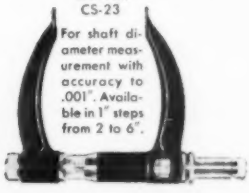
TELESCOPING GAGES

Cat. No. 70

Permit quick checking of inside measurements. Sizes from ½ to 6".

CRANKSHAFT MICROMETER

Cat. No. CS-23



For shaft diameter measurement with accuracy to .001". Available in 1" steps from 2 to 6".

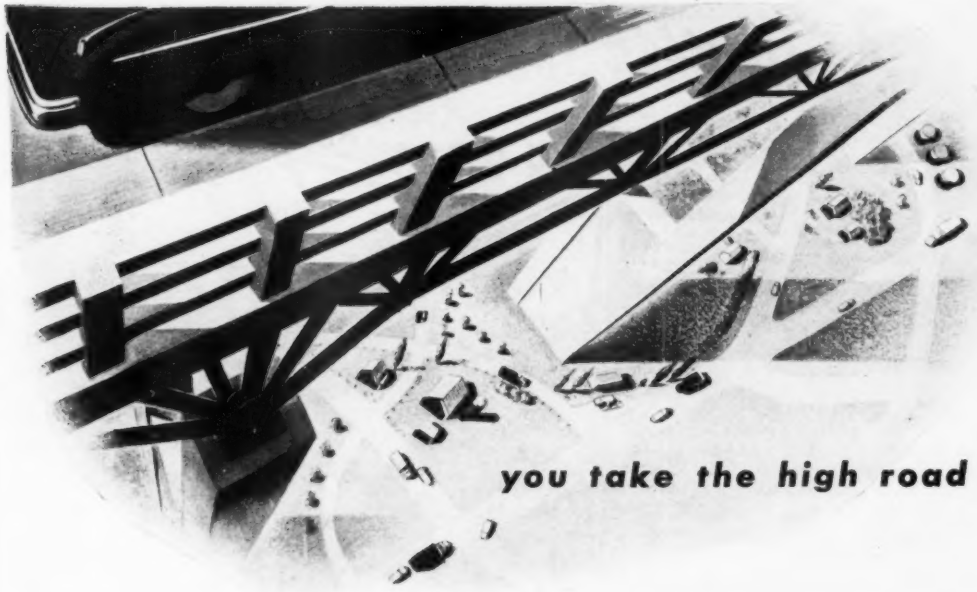
TUMICO

SEATTLE • LOS ANGELES • DENVER • DALLAS • CHICAGO • MINNEAPOLIS
KANSAS CITY • DETROIT • ATLANTA • NEW YORK • TORONTO, CANADA
EXPORT OFFICE: CHICAGO

Send for catalog and complete sales information

TUBULAR MICROMETER CO.

ST. JAMES, MINNESOTA, U.S.A.

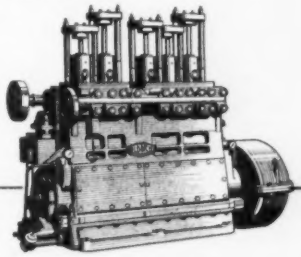


It's the short way home . . . when the high road means a straight line and a through-flow of traffic. It means too that you can get more work done today . . . and still more tomorrow.

Designed to give virtually the same results, the Aldrich Direct Flow Pump passes liquid *directly* through the working barrel. Aldrich design engineers have successfully eliminated two right angle turns in the fluid-end block.

This design, resulting in a reduction of "loss space", means more work done at less cost. Volumetric efficiency is improved and materials are saved. In each size, you get a smaller pump that does the same work better . . . which is why more people are coming to Aldrich for pumps made in 3", 5", 6" triplex; 5", 6" quintuplex and 5", 6" septuplex units . . . to meet medium-to-high pressure and capacity requirements.

Applications where Aldrich Direct Flow Pumps are operating today include: water flooding, salt water disposal, lean oil to absorbers, and the handling of diethylene glycol, gasoline, propane, butane. Request Data Sheets 64 and 64B for complete information.



THE ALDRICH PUMP COMPANY

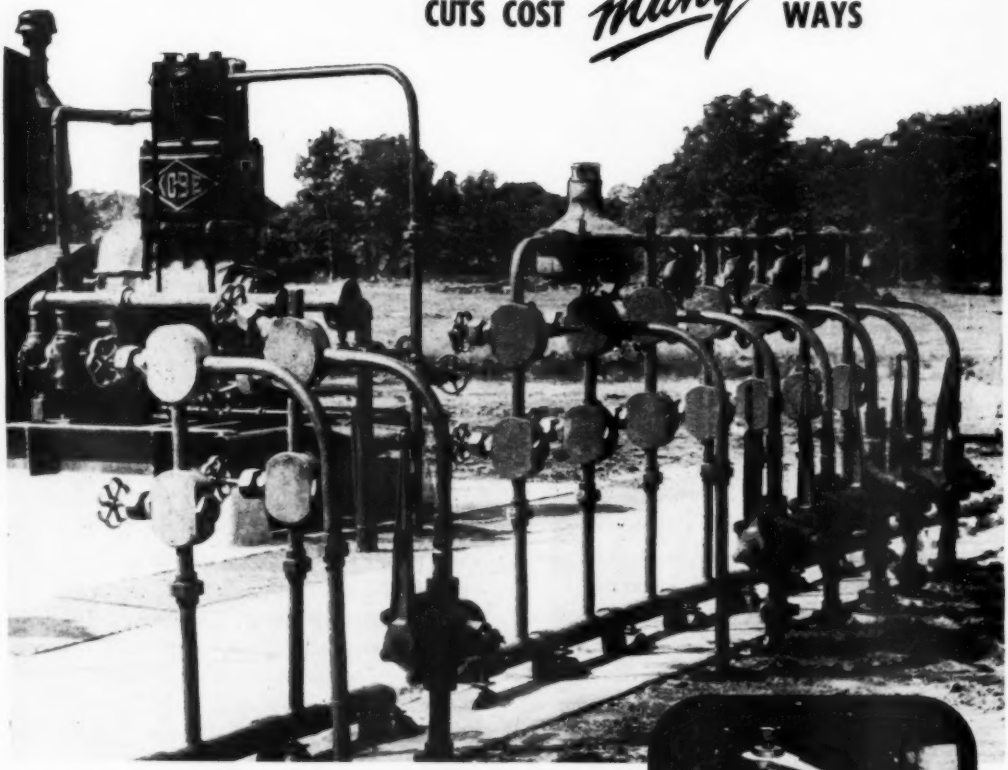
9 GORDON STREET • ALLENTOWN, PENNSYLVANIA

...Originators of the Direct Flow Pump

Representatives: P. H. Arden, P. O. Box 185, Glenview, Ill. • Bushnell Controls & Equipment Co., 3929 W. Jefferson Blvd., Los Angeles 16, Calif. • L. T. Gibbs, 509 Petroleum Bldg., Tulsa 3, Okla. • R. B. Moore Supply Co., Inc., Bolivar, N. Y. • Power Specialty Co., 2000 Kipling St., Houston 6, Texas • Reeves & Skinner Machinery Co., 2211 Olive St., St. Louis 3, Mo. Stearns-Roger Manufacturing Co., 1720 California St., Denver 2, Colo. • Export Sales: Petroleum Machinery Corp., 30 Rockefeller Plaza, New York 20, N. Y. • Birmingham • Boston Buffalo • Cincinnati • Cleveland • Detroit • Duluth • Jacksonville • Omaha • Philadelphia • Pittsburgh • Portland, Ore. • Richmond, Va. • San Francisco • Seattle • Spokane, Wash. • Syracuse

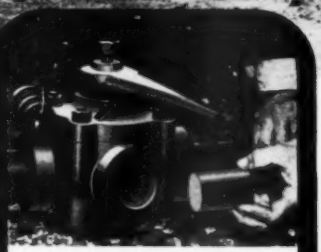
Prevents PARAFFIN PROBLEMS

CUTS COST *many* WAYS



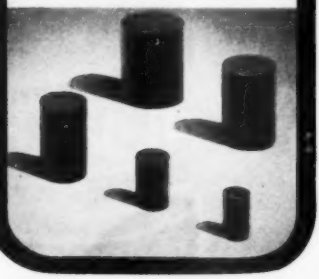
A typical example of how Kinney is controlling paraffin and effecting substantial savings for operators everywhere!

No STEAMING . . . No ROD PULLING . . . No CHEMICALS are employed in the Kinney Paraffin Control system. There are really only two basic features—the KINNEY PLUG INJECTOR VALVE and KINNEY SOLUBLE MECHANICAL PLUG. When utilized on FLOW LINES . . . FLOWING WELLS . . . OR ROD WELLS paraffin accumulation can absolutely be controlled *from the surface!* Think how much downtime is saved; and the tremendous savings in critical materials, equipment, and labor in addition to improved production performance. We can point to hundred of installations as solid reference of what Kinney will do. If you have paraffin problems it won't cost you one cent to get the Complete Kinney Paraffin Controlled from the surface story. WRITE — TODAY — for full details!



Above—KINNEY PLUG INJECTOR

Below—SOLUBLE MECHANICAL PLUGS

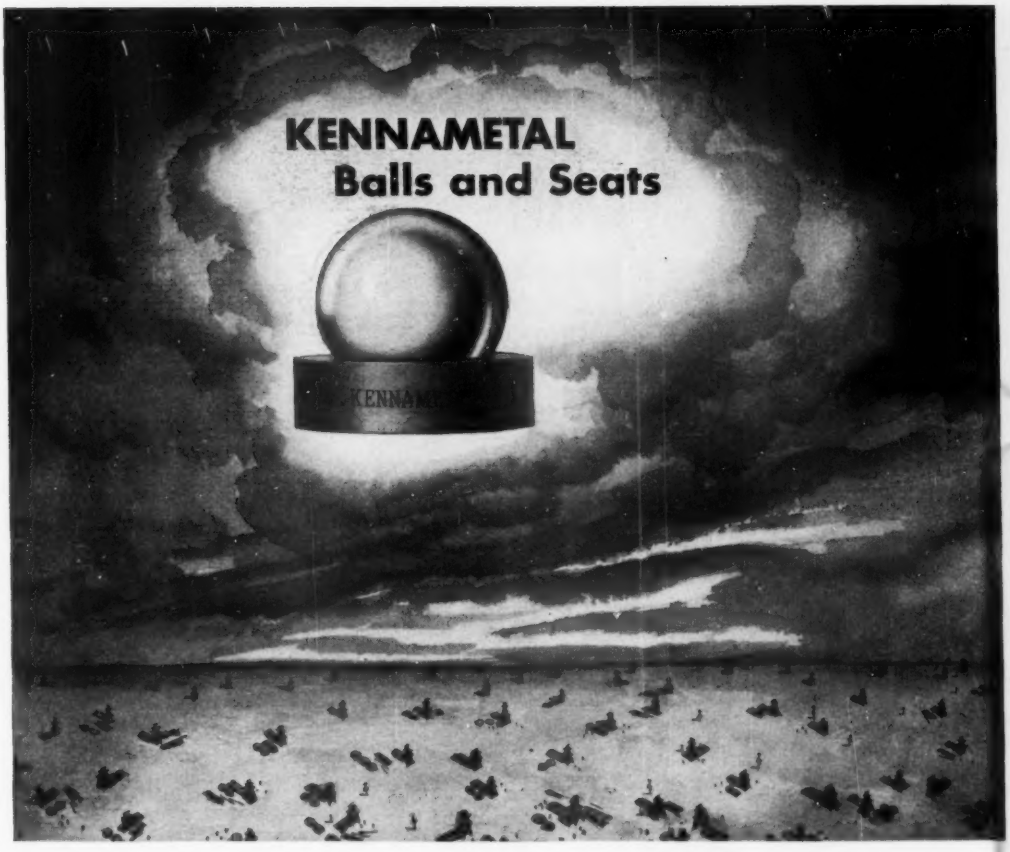


Kinney, Inc. ODESSA, TEXAS

P. O. BOX 3426 ★ TELEPHONE 4584

1418 EAST 5TH STREET

EXPORT: EASTMAN-INTERNATIONAL COMPANY ★ DENVER 1, COLORADO U.S.A.



Sky high in quality . . .

No other ball and seat gives the long valve service you'll get from Kennametal. It is the "vacuum-sintered" high quality cemented carbide made by an exclusive method which assures greater resistance to wear, greater strength and standard uniformity. It's much harder than steel, is corrosive resistant, non-magnetic, and outlasts alloy steel 20 to 1. Kennametal Balls and Seats offer maximum resistance to corrosion and pitting even under the most severe fluid pumping conditions. Because of these special qualities, you don't pull a pump because of valves when it is equipped with the Kennametal API Ball and Seat. One Texas oil producer reports, ". . . Kennametal Balls and Seats in my well had lasted 22.5 times as long as alloy steel balls—when first inspected . . . and even then showed no sign of wear." The Kennametal Ball and Seat had been in service for 448 days! The best service record of other balls and seats was only 20 days.

You will get better and longer service too—the Kennametal valve check "puts an end to down-the-hole check valve trouble," saves costly string pulls and production losses. It is precision ground and polished to stand an initial vacuum of 25 inches—5 inches above standard practice. Seats are available in both plain and rib type. Get high quality Kennametal Balls and Seats from your supply store or pump manufacturer today. Accept no substitute for *high quality* Kennametal Balls and Seats.

Kennametal

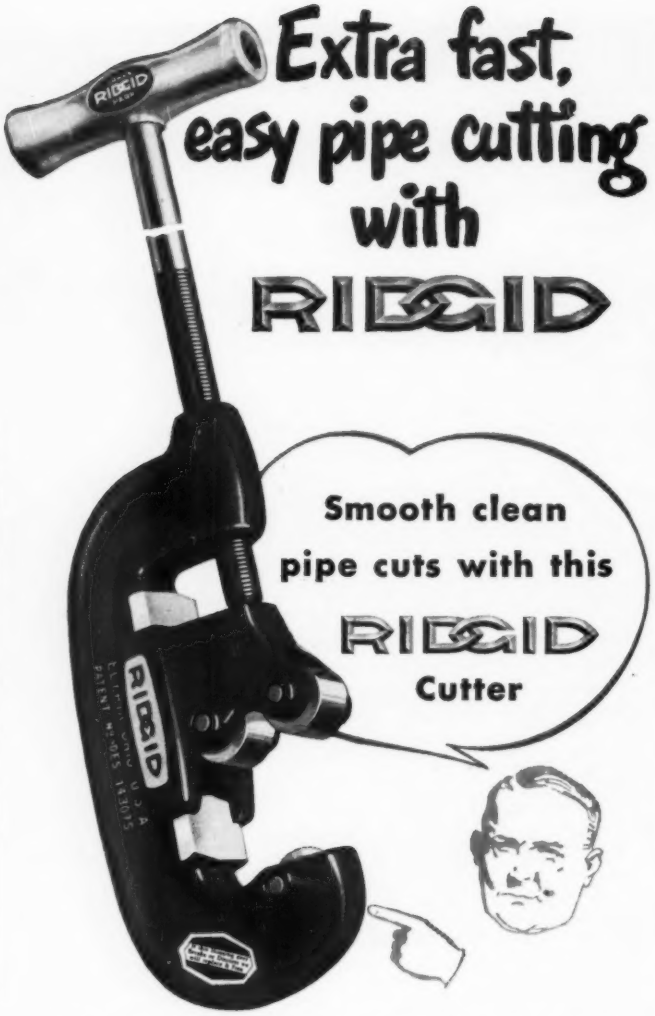
Balls and Seats

. . . put an end to down-the-hole check valve trouble

KENNAMETAL Inc., Latrobe, Pa.

Ask your supplier for Kennametal Balls and Seats

Extra fast, easy pipe cutting with RIDGID



● It rolls right through any pipe with least effort, quick almost burrless cuts—factory tested, tracks perfectly. Special thin-blade cutter wheel for extra fast cutting—or heavy-duty wheel for extra long service. Guaranteed warp-proof special malleable housing. Five models to 6" pipe; 4-wheel short-handle models for speedy cutting in tight places. For tops in clean easy pipe cutting, buy RIDGID Cutters at your Supply House.

RIDGID

★ Work-Saver Pipe Tools ★

They Say—

What Oil Movement Costs

"Industry-wide figures on oil transportation costs are not available. I have, however, some estimates for the Socony-Vacuum Oil Co., Inc.

"In 1950 Socony-Vacuum spent for transportation of all types about 16 per cent of its gross domestic income. Though it is impossible to allocate all costs to any particular product, we can definitely say that transportation is a very important element in the cost of gasoline at the service station. We estimate that it amounts to about 3 cents per gallon."

B. Brewster Jennings, president, Socony-Vacuum Oil Co., Inc., speaking before the National Industrial Traffic League, Chicago.

Nothing Phony

"One of Nebraska's major daily newspapers in preparing a 'Nebraska Progress' edition to be issued the first of the year. Naturally, the oil and gas development in the Sidney area will come in for important coverage.

"Commenting on this fact, a representative of the newspaper told The Telegraph: 'This oil and gas development is something we can really sink our teeth into because we know it is more than just a promise.' He was expressing the opinion of so many Nebraskans, who have spent years dreaming about better things for Nebraska. There's nothing phony about western Nebraska's oil and gas. It's the top news of our times."

Editorial in the Sidney, Neb., Telegraph.

Spectacle of Frustration

"With the national demand for oil growing greater than the national supply, and with Congress in default on authorizing the machinery for administering the underseas reserve, Secretary of the Interior Chapman is reduced to a desperate search of existing laws to find an excuse for discharging his responsibilities. At the same time Senator Connally of Texas, one of the states claiming the underseas oil, uses heated and intemperate language against the very administration whose chief officer of foreign policy he is in Congress. He warns the Government not to 'seize' the submerged oil lands, declaring it would amount to 'unprecedented and unmitigated defiance of the Congress and the people.'

"To a man looking on from another country, what a spectacle of impotence and self-frustration this must seem. Can it be that the American Supreme Court and the American

We hope he's on his way to your house..
GASO PUMP & BURNER MFG. CO.
902 EAST FIRST ST., TULSA, OKLA.
Good Health
Good Wealth
Good Cheer
Colicki

THE NIGHT BEFORE CHRISTMAS

by Jolly Saint "VIC"

'Twas the night before Christmas and right down the line
Not a drop was there leaking, even one at a time.
All sections were "locked" and "buttoned-up" tight
With Victaulic Couplings that made 'em just right.

All Elbows and Tees stayed right in their groove
For the Victaulic Method each fitting did prove.
With the world's best system for making ends meet
Each pipe and each fitting was tight in its seat.

Now all of this piping so good and so quick
Was the work of none other than jolly Saint "Vic"
So for better connections in the year '52
You'd better let "Vic" do that piping for you.

VICTAULIC COMPANY OF AMERICA
1100 Morris Avenue, Union, N. J.
Mailing Address: Box 509, Elizabeth, N. J.
Phone: Elizabeth 4-2141
Victaulic Inc., 727 W. 7th St., Los Angeles 14, Calif.
Victaulic Company of Canada, Ltd., 406 Hopewell Ave., Toronto 10
For Export outside U.S. & Canada: PIPECO Couplings & Fittings, Pipe Couplings, Inc., 30 Rockefeller Plaza, New York 20, N.Y.
27TH VICTAULIC YEAR

The easiest way to make ends meet
VICTAULIC
PIPE COUPLINGS AND FITTINGS
Copyright 1951, by Victaulic Co. of America

Congress are pitted against each other, the former telling the administration to go ahead, the latter telling it to stop? Can it be that the administration itself likewise divided and on dead center, the Truman-Chapman wing striving to move forward, the Connally wing waving the bloody shirt and daring it to stir from its tracks?

"Surely reasonable men can find a more reasonable way of dealing with an issue of so much consequence to the security of the nation."

Editorial in the St. Louis Post Dispatch.

Reasonable Assumption

"When the time comes for the production of synthetic gasoline, the oil industry will be in there producing it. Its leaders are convinced they know more about the oil business than does Washington. That has the earmarks of a reasonable assumption."

C. Norman Stabler, writing in the Wall Street Journal.

Blind Alley?

"Whatever the fundamental issues in the Anglo-Iranian dispute, it seems fair to conclude that Iran's fiery politicians have steered their economic buggy up a blind alley from which there may be no return. The world is getting used to doing without Iranian oil and without the giant Abadan refinery. The American oil industry, although hard pressed by meager allocations of steel and by other handicaps, has already taken up most of the slack.

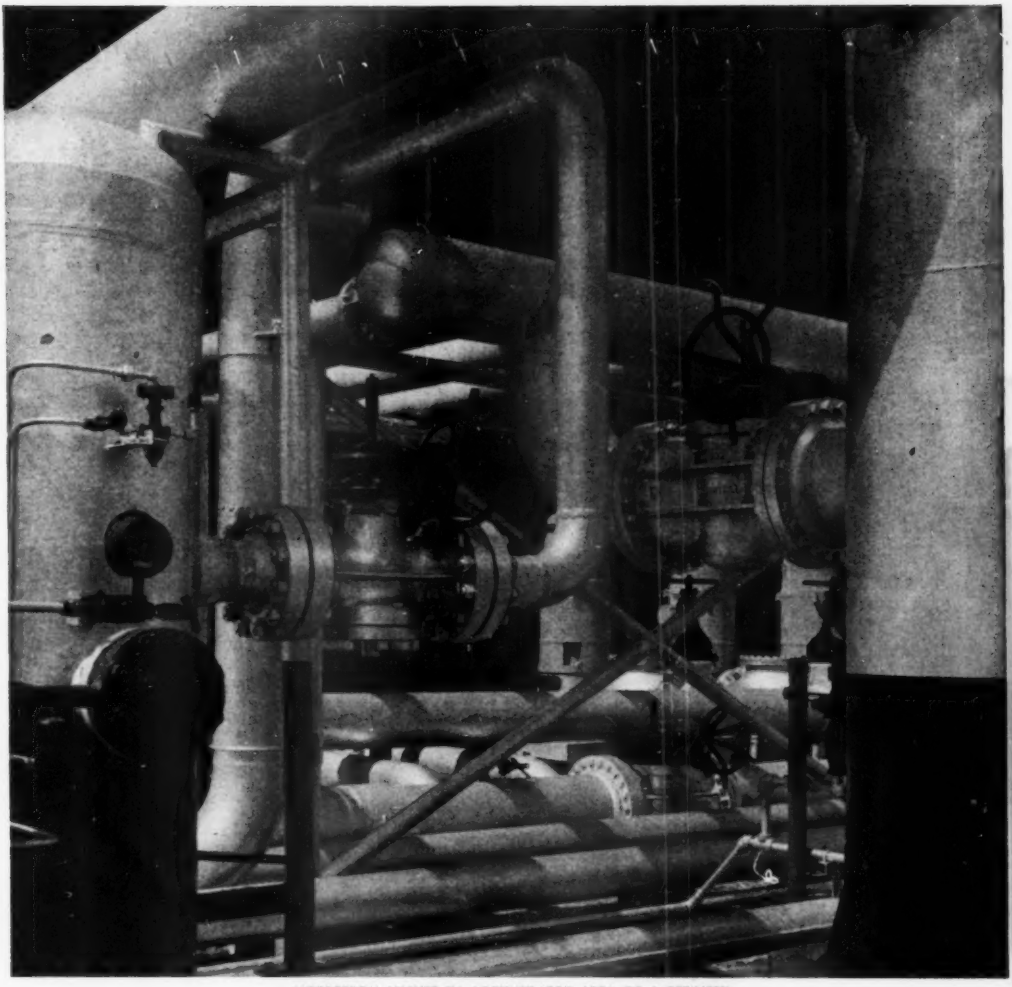
"Oil brought employment and wealth into Iran. Maybe Iran should have had a bigger share of the oil money—perhaps as much as Saudi Arabia gets from American oil companies. Maybe too much oil money stuck to the fingers of well-connected Iranian politicians. Nevertheless, the emotional stubbornness of Iran's leaders has resulted, for the time being at least, in scuttling their country's economy.

"One lesson from this is that some 'underdeveloped' countries don't want to have anything to do with foreigners, even though they may come bearing 'technical aid.' Another lesson is that colonial peoples would rather run their own affairs even at considerable sacrifice. You can't blame them for that. But they shouldn't come running to the American taxpayer for a dollar transfusion to get them out of trouble."

Editorial in the Saturday Evening Post.

Like War, No Winner

"The West may comfort itself with the thought that the Mossadegh administration is in political trouble at

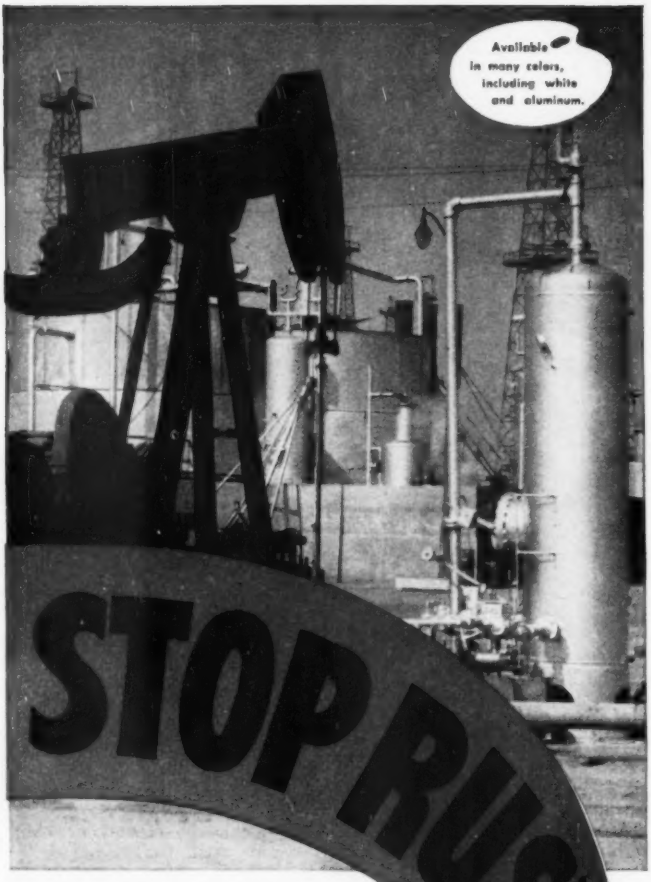


NORDSTROM VALVES IN ACCUMULATOR AREA OF A REFINERY

A picture of good engineering

Nordstrom Valves

ROCKWELL MANUFACTURING COMPANY 400 North Lexington Avenue, Pittsburgh 8, Pa.



Save Metal with

RUST-OLEUM

Silently, but ruthlessly (even as you are reading this) rust is gnawing away at your tanks, pumps, derricks, refining equipment, buildings, roofs, fences—every rustable metal—inside and outdoors.

To protect your investment—to keep every possible pound of new steel for the defense program—*adopt rust control with Rust-Oleum as an important part of your maintenance program.*

RUST-OLEUM stops rust. It can be applied *even* over rusted surfaces. It is not necessary to remove all the rust. Just use wire brush and sharp scraper to remove rust scale and loose rust.

RUST-OLEUM can be obtained promptly from Industrial Distributors' stocks in principal cities of the United States and Canada. Write on your company's letterhead for complete catalog and nearest source of supply.

RUST-OLEUM CORPORATION
2541 Oakton Street, Evanston, Illinois

• Stocked and Sold by Leading Industrial Distributors in All Principal Cities of the United States and Canada

home and that the physical delivery of oil from Iran to Czechoslovakia or Poland would be hard to arrange. The Iranian Government may try to make itself believe that economic dependence on the Soviet Union would not curtail the nation's independence, since in the words of the deputy premier 'business and politics do not mix.' But the truth remains that the sooner a decent settlement can be effected between Britain and Iran, the better for all concerned. A waiting game could be one in which both sides lose."

Editorial in the Kansas City Star.

CALENDAR

December

American Association for the Advancement of Science, annual meeting, Philadelphia, December 27-28.

1952 Meetings

January

Pipe Line Contractors Association, annual meeting, Shamrock Hotel, Houston, January 8-9.

Society of Automotive Engineers, annual meeting, Hotel Book-Cadillac, Detroit, January 14-18.

Compressed Gas Association, Inc., annual meeting, Waldorf-Astoria, New York City, January 21-22.

February

American Society for Testing Materials, Committee D-2 on petroleum products and lubricants, Shoreham Hotel, Washington, D. C., February 3-8.

Missouri Petroleum Association, annual convention and trade exhibit, Jefferson Hotel, St. Louis, February 4-6.

Instrument Society of America, New York Section, power-plant symposium, Hotel Statler, New York City, February 7-8.

American Petroleum Institute, Division of Marketing, lubrication-committee meeting, Hotel Book-Cadillac, Detroit, February 18-19.

Wisconsin Petroleum Association, twenty-sixth annual convention and equipment show, Milwaukee Auditorium, Milwaukee, February 26-27.

American Association of Petroleum Geologists, Rocky Mountain Section, annual meeting, Salt Lake City, February 28-29.

March

American Society for Testing Materials, spring meeting, Hotel Statler, Cleveland, March 3-7.

American Petroleum Institute, Division of Production, southwestern district, Washington-Youree Hotel, Shreveport, March 5-7.

National Association of Corrosion Engineers, eighth annual conference and exhibition, Galvez Hotel, Galveston, Tex., March 10-14.

American Institute of Chemical Engineers, regional meeting, Atlanta, March 16-19.

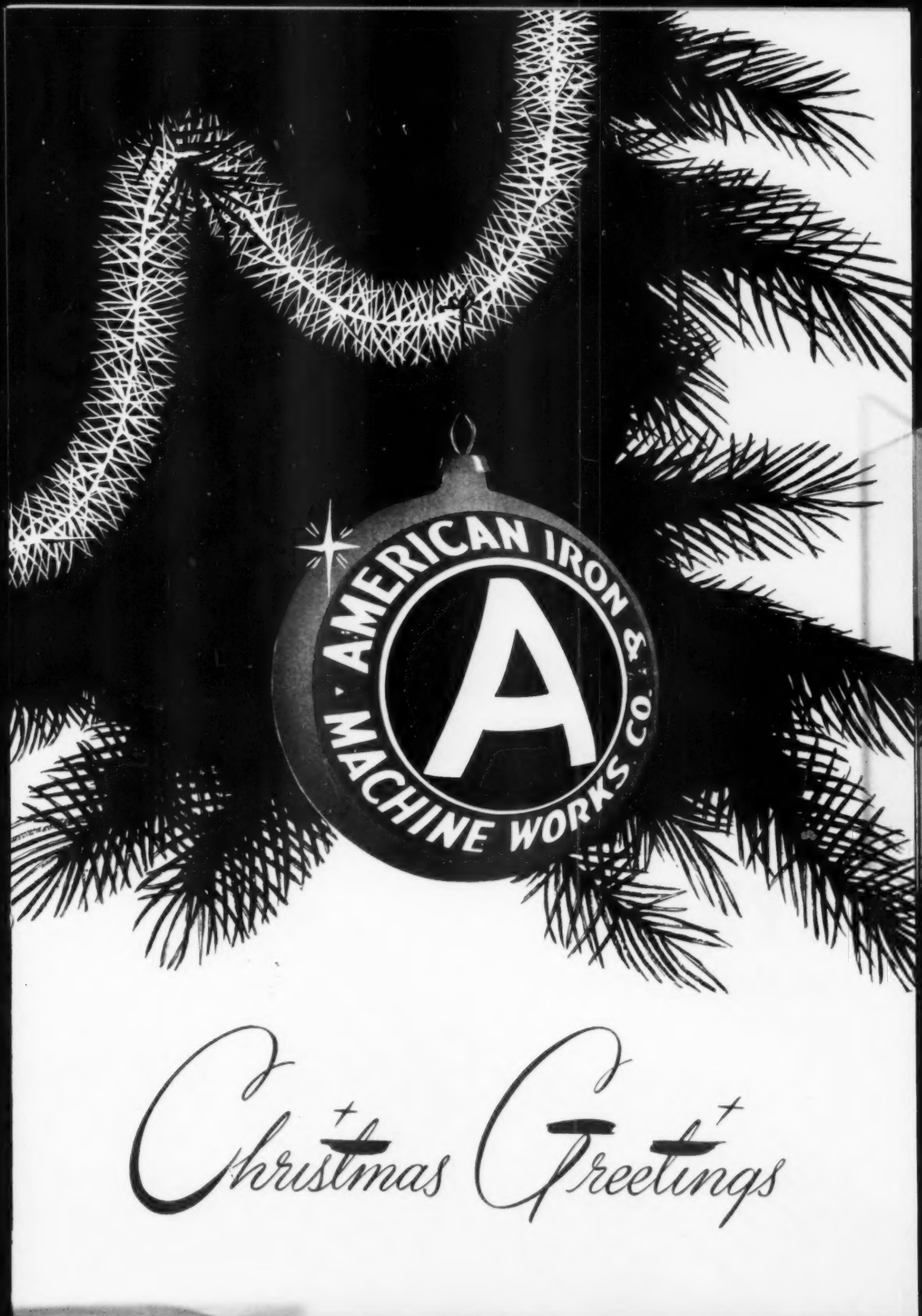
American Petroleum Institute, Division of Production, Mid-Continent district meeting, Broadview Hotel, Wichita, Kans., March 21.

American Association of Petroleum Geologists, Society of Economic Paleontologists and Mineralogists, and Society of Exploration Geophysicists, joint annual meeting, Biltmore Hotel, Los Angeles, March 23-27.

Western Petroleum Refiners Association, annual meeting, Plaza Hotel, San Antonio, March 31-April 2.

April

American Petroleum Institute, Division of Production, eastern district, Hotel William Penn, Pittsburgh, April 2-4.


AMERICAN IRON & MACHINE WORKS CO.
A
Christmas Greetings

eliminate corrosion with TENITE *pipe . . .*

Many miles of Tenite pipe are now in service in the oil fields carrying sour crude oil and salt water.

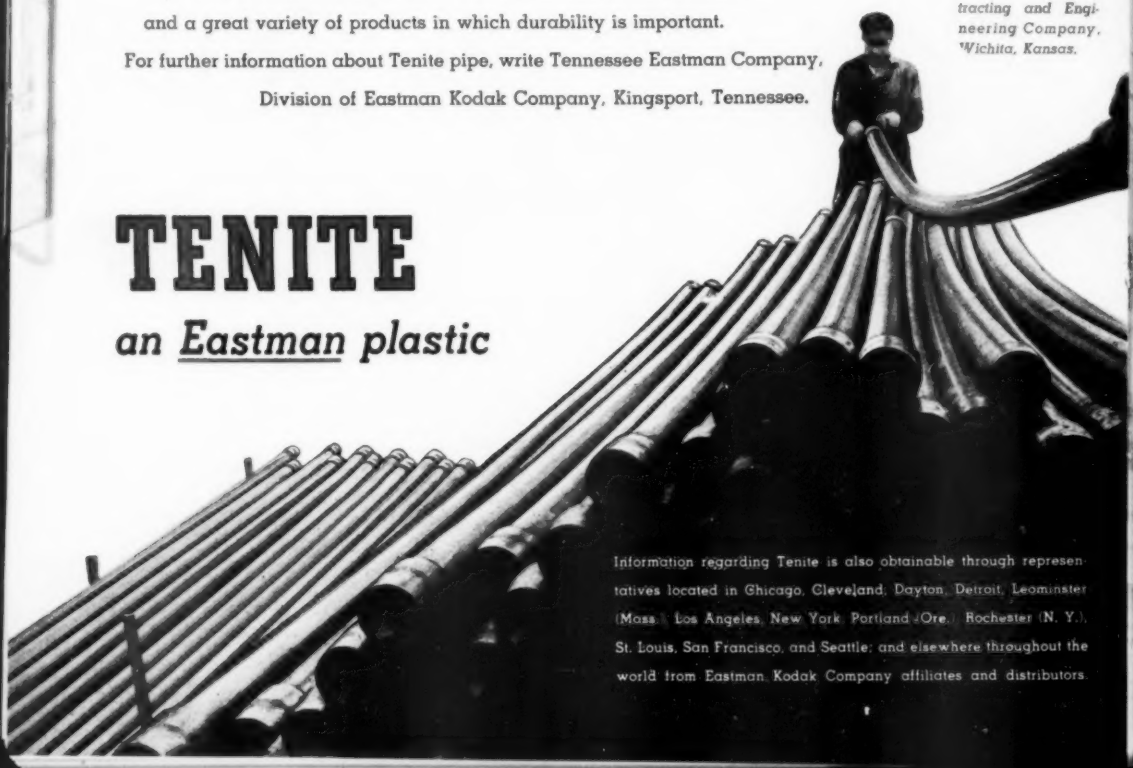
The smooth-walled Tenite pipe weighs only a fraction as much as steel pipe and requires no special equipment to install — one man can easily shoulder two 20-foot lengths. Slip-sleeve and molded Tenite couplings assemble the lengths speedily and permanently.

Tough, noncorrodible Tenite pipe has high impact strength, weathers well, is flexible enough to follow earth contour and to withstand expansion caused by ice formation.

Long successful in both outdoor and indoor applications, Tenite is also effectively used for irrigation tubing, traffic markers, and a great variety of products in which durability is important.

For further information about Tenite pipe, write Tennessee Eastman Company, Division of Eastman Kodak Company, Kingsport, Tennessee.

● *Oil field tubing extruded by Carlon Products Corporation, Cleveland, Ohio, and distributed by Green Contracting and Engineering Company, Wichita, Kansas.*



TENITE

an Eastman plastic

Information regarding Tenite is also obtainable through representatives located in Chicago, Cleveland, Dayton, Detroit, Leominster (Mass.), Los Angeles, New York, Portland (Ore.), Rochester (N. Y.), St. Louis, San Francisco, and Seattle; and elsewhere throughout the world from Eastman Kodak Company affiliates and distributors.

Southwestern Gas Measurement Short Course, University of Oklahoma, Norman, April 8-10.

American Institute of Electrical Engineers, District 7 meeting, Hotel Jefferson, St. Louis, April 15-17.

American Petroleum Institute, Division of Transportation, pipe-line conference, Blackstone Hotel, Fort Worth, April 21-23.

American Petroleum Institute, Division of Production, Rocky Mountain district, Gladstone Hotel, Casper, Wyo., April 24-25.

Southern Gas Association, annual convention, Galveston, Tex., April 28-30.

American Institute of Electrical Engineers, District 1 meeting, Binghampton, N. Y., April 30-May 2.

Natural Gasoline Association of America, annual meeting, Rice Hotel, Houston, April 30-May 3.

May

American Geophysical Union, thirty-third annual meeting, National Academy of Sciences, National Research Council, Washington, D. C., May 5-7.

American Institute of Chemical Engineers, regional meeting, French Lick, Ind., May 11-14.

American Association of Petroleum Geologists, regional meeting, Mayo Hotel, Tulsa, May 12-13.

American Gas Association, Natural Gas Department, spring meeting, Biltmore Hotel, Los Angeles, May 12-13.

American Petroleum Institute, Division of Refining, seventeenth midyear meeting, San Francisco, May 12-15.

American Petroleum Institute, Division of Production, Pacific Coast district, Biltmore Hotel, Los Angeles, May 15-16.

American Petroleum Institute, Division of Marketing, midyear meeting, Copley Plaza Hotel, Boston, May 19-20.

Gas Appliance Manufacturers Association, annual meeting, Broadmoor Hotel, Colorado Springs, Colo., May 21-23.

American Gas Association, production and chemical conference, Hotel New Yorker, New York, May 26-28.

Society of Exploration Geophysicists, Gulf Coast regional meeting, Rice Hotel, Houston, May 29-30.

June

Pennsylvania Grade Crude Oil Association, annual meeting, Hotel William Penn, Pittsburgh, June 5-6.

Canadian Gas Association, Chateau Frontenac, Quebec, June 8-12.

American Petroleum Institute, midyear standardization meeting, Brown Palace Hotel, Denver, June 9-14.

Petroleum Equipment Suppliers Association, Mark Hopkins Hotel, San Francisco, June 22-25.

American Society for Testing Materials, annual meeting, Hotel Statler, New York, June 23-27.

American Institute of Electrical Engineers, summer general meeting, Hotel Statler, New York City, June 23-27.

September

American Institute of Chemical Engineers, regional meeting, Palmer House, Chicago, September 11-13.

American Association of Oilwell Drilling Contractors, annual meeting, Skirvin Hotel, Oklahoma City, September 28-30.

NOMADS

Tulsa Nomads, third Friday of each month. After Five Room, Tulsa Hotel.

Tulsa Nomads, annual ball, Mayo Hotel, January 18.

Dallas-Fort Worth Nomads, first Monday of each month, Greater Dallas Club.

Houston Nomads, second Monday of each month, Ye Ole College Inn, Houston.

Los Angeles Nomads, second Wednesday of each month, Jonathan Club.

BARGE FACILITIES at PLS-Harvey, La.

To Serve You Better in the Gulf Coast Area

Located on the Intra-Coastal Canal across the Mississippi River from New Orleans, the modern PLS plant at Harvey provides most complete facilities for handling shipments by water, as well as by rail and truck. Thus, pipe can be shipped direct from the tube mills—cleaned, primed, coated and wrapped—and then re-shipped by barge, rail or truck to points on the Gulf Coast or overseas.

It's another plus in PLS service.

PLS

PIPE LINE SERVICE CORPORATION

Pioneers in Steel Pipe Protection

General Offices and Plant: Franklin Park, Illinois

Plants at Glenwillard, Penna.; Longview, Texas; Corpus Christi, Texas; Harvey, La.; Sparrows Point, Md.

20 Years of Dependable Service

WHEN THE JOB IS TOUGH

W. C. NORRIS MANUFACTURING, INC.

TULSA, OKLAHOMA

WEST COAST DISTRIBUTORS
NORRIS PIPE & SUPPLY CO.
Los Angeles

BRANCHES
HOUSTON, DALLAS, [illegible], TEXAS
SAVAGE, MINNESOTA, [illegible]
EXPORT: 30 ROCKEFELLER PLAZA, NEW YORK

Published every Thursday by The Petroleum Publishing Co., 211 S. Cheyenne, Tulsa, Oklahoma. Founded in 1902. Name changed to The Oil and Gas Journal in 1910 by Patrick C. Boyle.

P. C. LAUINGER
President

S. H. ROURKE
Executive Vice President

HANSON B. PIGMAN
Circulation Manager

ADVERTISING
MITCHELL TUCKER
Vice President

New York Office
500 Fifth Avenue, Phone LOngacre 4-1750
CHARLES A. WARDLEY
Eastern Manager

ROBERT N. CAIRD, JR.
Representative

Chicago Office
105 West Madison, Phone Central 6-2537
C. R. FARMER
Manager

E. S. KLAPPENBACH
Representative

Pittsburgh Office
429 Fourth Ave., Phone Atlantic 1-4835
ALFRED M. JONES
Manager

Tulsa Office
211 S. Cheyenne, Phone 3-6291
JOHN D. REILLY
Mid-Continent Manager
J. PARKER HOLLAND
Production Manager

Houston Office
Sterling Building, Phone Charter 4626
JOHN M. SPEARS
Gulf Coast Representative

Los Angeles Office
450 S. Grand Ave., Phone Vandike 0722
DONALD O. HANSON
Manager

England Office
111 Thorley Lane, Timperley, Cheshire
HARRY BECKER
European Representative
Phone Ringway 4702

Subscription rate to the petroleum industry, United States and foreign, 1 year, $3.00. Single copies, 50 cents. Back copies when over a year old, one dollar. Note: Payments from outside the U.S.A. may be in the form of an international money order or check on a U.S.A. bank. Entered as second-class mail matter at Tulsa, Okla., under Act of March 3, 1879. Copyright 1951 by The Petroleum Publishing Co.

Member
Audit Bureau of Circulations
Associated Business Papers

JOURNALLY Speaking

Our Day

AS a Christmas present, or, more accurately, a New Year's present, to all its subscribers, our favorite oil publication is changing its publication date. After the first of the year it will be dated Monday of each week, and (the U. S. mail willing) it should reach most subscribers that day.

Making this change was no hasty decision. It has been under consideration for a long time, and is being done to provide better service to the readers.

For more than 40 years the Big Yellow Book has been dated Thursday, though nobody now recalls exactly why that day was selected in the first place. It used to be that most subscribers got their copies on Thursday or Friday, but that was before there were so many of them scattered all over the United States. Now a lot of readers are in such remote places (remote from Tulsa, that is) that, the mail service being what it is, they don't get delivery until Monday. Of course, it reaches some offices Saturday, but because of the popularity of the 5-day week that doesn't do much good.

So we decided to let the magazine travel during the two nonbusiness days every week, and thus reduce the number of business days which elapse between the time we start our presses rolling and the time you start your on-the-job reading.

Another purpose is to permit our editorial staff to do a better job of rounding up, interpreting, and presenting the important newsworthy events of the far-flung petroleum industry. As it is now, things that happen early in the week have to be reported with such speed that sometimes our editors can't evaluate and coordinate them effectively, what with deadlines breathing down their necks. The new printing and mailing schedule will, we are quite sure, result in fresher news, better news, and an all-around improved presentation of the technical, statistical, and news reports so essential in keeping up with the fast pace of the industry these days.

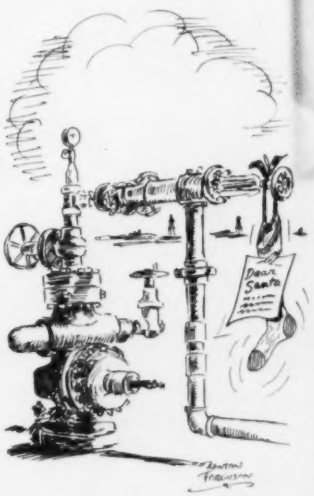
So we are making the change, and the shift in our operating schedule will take place over the New Year holiday, when all business schedules are shot to pieces anyway.

Merry Christmas

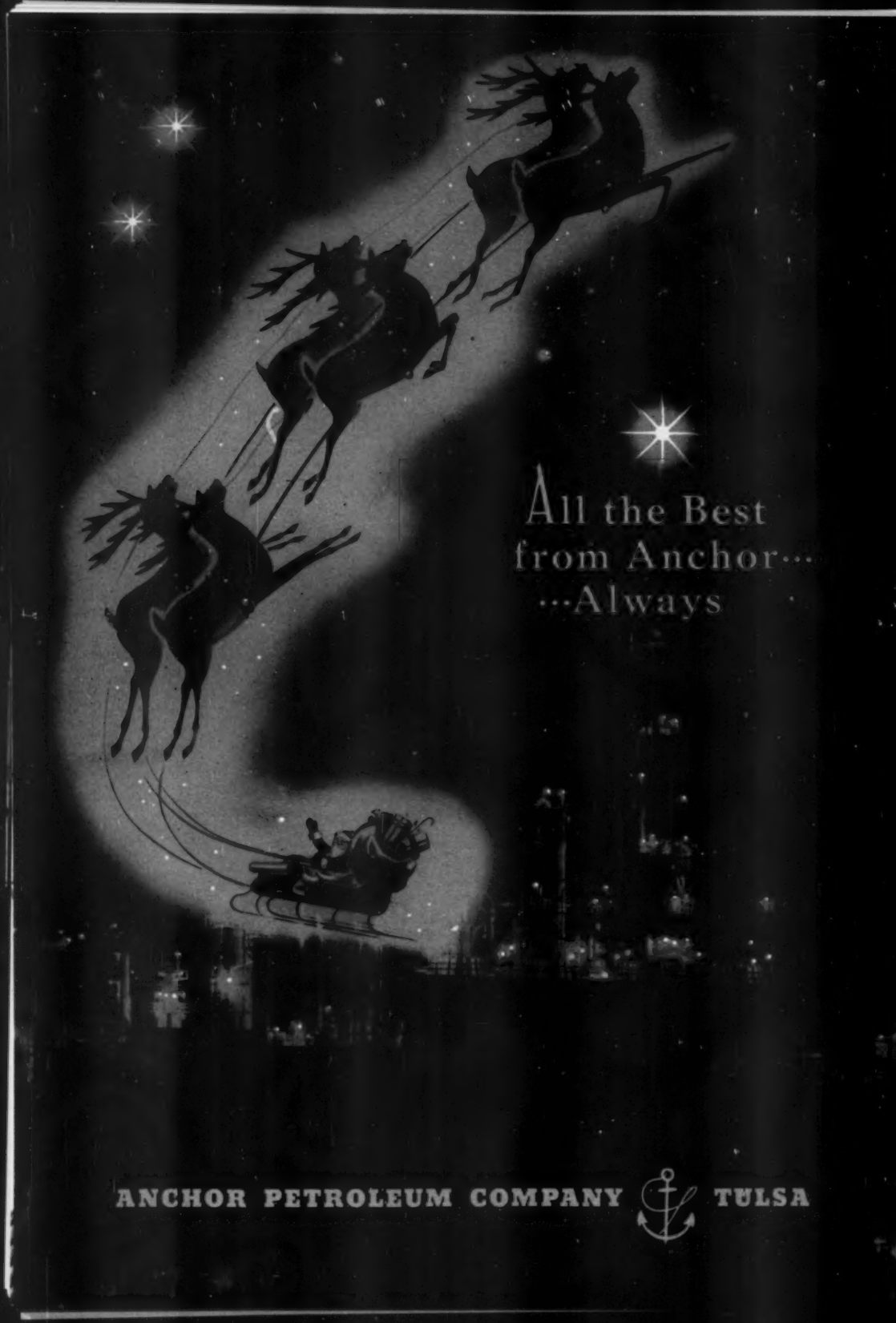
THIS is the week when every writer of an oil column is tempted to write an open letter to Santa Claus listing all the things the oil industry would like to have given to it during the coming year. We admit having given in to this temptation in the past, and we won't promise not to succumb in the future.

If we were going to write such a letter this year we would start off by asking for an end of the hot war in Korea and the cold war everywhere, plenty of steel, and the dropping of emergency controls. Then, of course, we would ask for higher prices, lower taxes, and assurance that the depletion allowance would not be attacked.

Following that we would ask Santa for big discoveries in new areas, fewer dry holes, and a lot of other things. But we're not going to do it. Instead, we're just going to let Benton Ferguson's cartoon suggest the whole idea, and wish everybody a Merry Christmas.



—*Henry D. Ralph.*


All the Best
from Anchor···
···Always
ANCHOR PETROLEUM COMPANY
TULSA

the OIL AND GAS JOURNAL

December 20, 1951

VOL. 50, NO. 33

EDITOR
C. O. WILLSON

MANAGING EDITOR
Kenneth B. Barnes

NEWS EDITOR
Henry D. Ralph

REFINING EDITOR
George H. Weber
500 Fifth Avenue, New York

INTERNATIONAL EDITOR
Dahl M. Duff
500 Fifth Avenue, New York

PIPE-LINE EDITOR
Paul Reed

TECHNICAL EDITOR
W. L. Nelson

ASSOCIATE EDITORS
Lynn M. Nichols
Neil Williams
R. B. Tuttle
Philip C. Ingalls
John C. Casper

DISTRICT EDITORS
D. H. Stormont
650 S. Grand, Los Angeles
Carl F. Hoot
Mercantile Bank Bldg., Dallas
Victor Lauriston
35 Stanley, Chatham, Ont.
Bertram F. Linz
621 Albee Bldg., Washington
Walter Rose
Sterling Bldg., Houston
F. Lawrence Resen
Sterling Bldg., Houston
Ted A. Armstrong
211 S. Cheyenne, Tulsa
Joseph A. Kornfeld
211 S. Cheyenne, Tulsa
John C. Reidel
211 S. Cheyenne, Tulsa
William P. Sterne
211 S. Cheyenne, Tulsa
Robert J. Enright
211 S. Cheyenne, Tulsa
Roy F. Carlson
McClintic Bldg., Midland, Tex.

EDITORIAL ASSISTANTS
Connie Farrar, Tulsa
Martha Allbright, Tulsa
Lucy Dee Owen, Houston

CORRESPONDENTS AT
Denver, Pittsburgh, Calgary, Columbus, Ashland, Ky., Oil City, Pa., and Mount Pleasant, Mich.

• NEWS FEATURES

Spraberry Area Assuming Some Definition; 800 Wells Completed 173
Steel Supply, Controls, Taxes, Depletion Allowance Worry Texas Operators 174
Rapid Growth of Underground Storage a Virtual Gas-Industry Revolution 175
Oil Regulation Is a State Job, Governors Agree at Compact Meeting 177
U. S. Oil Wells Could Produce 510,168 Bbl. More Daily, Shivers Says 178
Markham Honored by A.P.I.C.; Retires December 31 178
Crude Imports Gained 95,000 Bbl. Daily in October; Exports Dropped 179
PAD Revises Order M-46 180
Spencer Says Sinclair Will Step Up Its Research Program 181
Socony Demonstrates New Fire-Fighting Technique 182
Trans-Mountain Gets Franchise to Build Canadian Crude Line 183
Venezuela Using Compact-Approved Conservation Methods 183

• INTERNATIONAL OIL REPORT SECTION

Oil Realm Is Far Flung 188
World Petroleum Operations by Countries 190
Drilling and Producing Techniques in Saudi Arabia 197
New Petrochemicals Plant in Great Britain 201
Creole Operates Two Multifunction Plants 204
Expansion in Burma Under Way, After Long Delay 206
Exploration Gets Results in Saudi Arabia 208
International Petroleum's Peruvian Operations 216
Middle East Accounts for More Than Half of World's Reserves 224
World Production at All-Time High 229
Caltex-Fiat Builds Pipe Line and Refinery in North Italy 232
Status Report on Canadian Oil and Gas Exploration 238
Winnipeg Refinery Designed to Produce Complete Product Range 249
Analysis of Canada's Golden Spike Reservoir 259
Activity in Western Canada Soars to Highest Peak 264
World Demand to Continue Upward Trend 270
The World's Tank-Ship Fleet—An Analysis 280
Brazilian Products Line Starts Operation 284
Expansion at Cardon Will Make It South America's Largest Refinery 287
More German Crude From Nonsalt-Dome Structures 292
Mud-Treating Procedures in Venezuela's Bolivar Coastal Field 295
Drilling in Eastern Venezuela 297
Oil Exploration in Western New Guinea 308
Third A.I.O.C. Refinery in U. K. Has Many New Features 310
Japan Speeding Refinery Rehabilitation 312
Shell to Operate 30 Per Cent of Total European Refining Capacity 314
England's Manchester Refinery Undergoing Expansion Program 320
Petroleum Possibilities in Central America 321
Nearly Half Million Wells Strain to Meet Mounting World Needs 334
Journal's International Survey of Oil Fields 335
Refining-Output Gains Elsewhere Balance Abadan Loss 347
Journal's International Survey of Oil Refineries 348

• ENGINEERING-OPERATING FEATURES

Progress in Metals 357
Engineering Fundamentals—Permeability Distribution 359
Refiner's Notebook—Steam-Turbine Controls 361
Other Engineering and Operating Articles in Special International Section 187

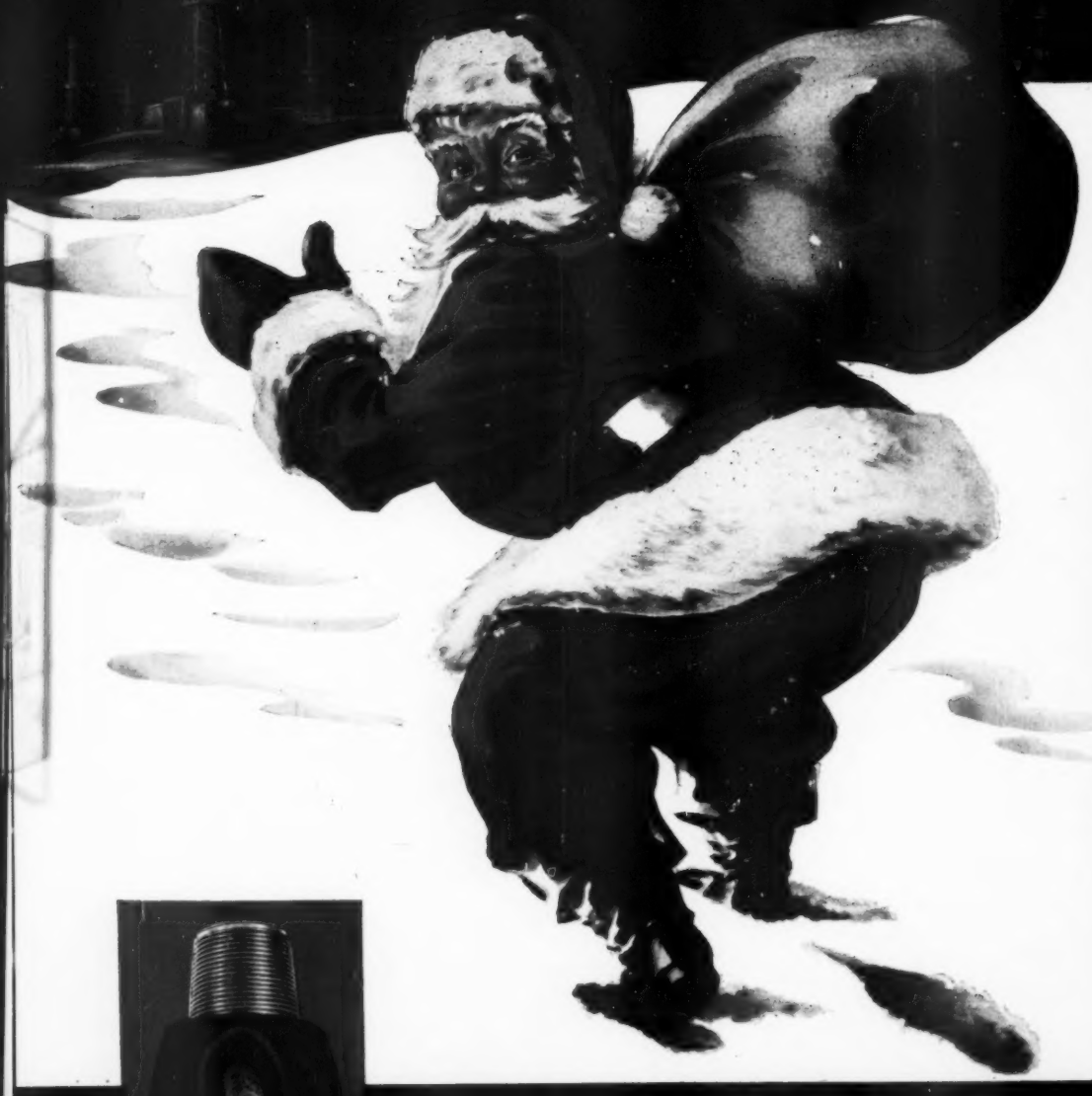
• EXPLORATION-DEVELOPMENT

Encouraging Signs in Anadarko Area 379
Highlights in Week's Developments 379
Reports by Areas Start on Page 380

• REGULAR DEPARTMENTS

They Say 158
Calendar of Events 162
Journally Speaking 167
Editorial 171
This Week 172
Personals 184
Deaths in the Industry 186
Book Reviews 302-332
Pipe-Line News 363
Natural-Gas News 369
Natural-Gasoline News 369
Drilling Contractors 371
Running High 371
Refining News 375
Exploration Statistics 406
Production Statistics 407
Refining Statistics 408
Market Statistics 409
Equipment Men in News 410
Classified Advertising 412
Advertisers' Index 417

The Best Of The Season To You And Yours



H C Smith OIL TOOL CO.

An International Industry

The global character and the international interdependency of petroleum were never more apparent than during the year now closing. The world has become painfully aware that a major happening in one region has a reaction throughout the entire industry.

The defense plan of the free peoples required world-wide coordination and capacity operation of petroleum facilities. Responding to this need, the international oil industry this year supplied approximately 4¼ billion barrels of products, nearly double its output of only 11 years ago, and at the same time increased the world's proven reserves by four or five times that amount. These reserves now exceed 100 billion barrels.

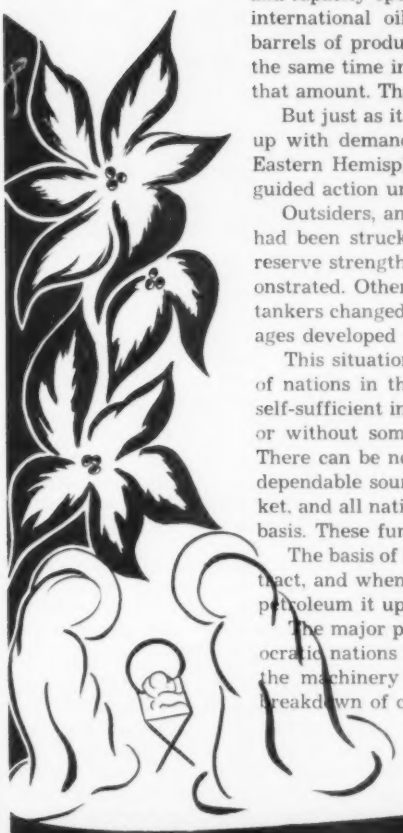
But just as it appeared at midyear that the world's industry had caught up with demand, the important Iranian supply at the crossroads of the Eastern Hemisphere was rapidly withdrawn from world markets by misguided action under the banner of nationalization.

Outsiders, and many within the oil industry, felt that a crippling blow had been struck endangering the entire defense program. But again the reserve strength and interdependence of the world oil business were demonstrated. Other countries stepped up production of fields and refineries, tankers changed their courses, storage was drawn on, and no serious shortages developed anywhere.

This situation raises the question—still unsettled—of the responsibility of nations in their international oil dealings. No nation is so completely self-sufficient in petroleum that it can do without some exports or imports, or without some capital, materials, or technical assistance from abroad. There can be no orderly progress unless consuming nations are assured a dependable source of supply, producing nations are assured a steady market, and all nations can interchange funds and personnel on a business-like basis. These fundamentals cannot be compromised.

The basis of such mutual assistance and benefit is the instrument of contract, and when any nation fails to fulfill an important contract involving petroleum it upsets the economy and the defense of the rest of the world.

The major problem for the oil industry and for the community of democratic nations raised by the events of 1951 is that of developing or using the machinery of international justice and organization to prevent the breakdown of contracts and thus keep oil an international industry.



Merry Christmas

THIS WEEK

INTERNATIONAL OIL.—Clouds and palms, symbols of storms and of peace, form a mixed picture for the world's oil industry during the coming year. What the industry accomplished during 1951, how it did it, and what is ahead for the future are reviewed in this annual International Number of the Journal.

PRODUCTION.—West Central Texas operators worried about steel supply, taxes, depletion allowance, governmental controls, but say they can continue major contribution to nation's oil needs if conditions don't materially change. . . . ¶Vast Spraberry trend of West Texas now has 800 producing wells, with 120 being added monthly. . . . ¶Washington State finals gas-condensate producer to become the second West Coast oil state. . . .

WASHINGTON.—Regulations for procurement of controlled materials by oil, gas operators substantially revamped by NPA in rewritten Order M-46. . . . ¶Bruce Brown of PAD says new policy calls for priorities for new oil and gas equipment only when old equipment is turned in to scrap drive. . . .

CANADA.—Trans-Mountain wins franchise to build 695-mile, 24-in. crude-oil line via all-Canadian route from Edmonton to Vancouver. . . . Initial capacity will be 37,500 bbl. daily, to be later stepped up to 75,000 bbl. daily. . . . Three other firms withdraw applications. . . .

REFINING.—New 6,000-bbl. daily packaged T.C.C. unit placed on stream at New Mexico Asphalt & Refining Co.'s Artesia, N. M., plant. . . . ¶Shell begins $3,000,000 petrochemical project at Montreal East refinery, to synthesize 20,000,000 lb. annually of isopropyl alcohol and acetone from propylene. . . . ¶Republic Oil Refining Co. plans $7,000,000 expansion program. . . .

INDUSTRY.—Regulation of oil industry is the state's responsibility, governors declare at Compact Commission meeting. . . . Such methods will assure that nation will always have ample supplies of oil and achieve greatest amount of conservation. . . . ¶Shivers says oil wells in the United States can produce 510,168 bbl. per day more than they are now producing. . . . ¶Baird H. Markham honored by American Petroleum Industries Committee. . . . Will retire December 31. . . . ¶I.C.C. reports increases of nearly 10 per cent in volume, 12.6 per cent in transportation revenue by 52 larger oil-pipe-line companies during third quarter. . . .

NATURAL GAS.—Near revolution in the natural-gas industry brought about by rapid growth of underground-storage projects, Compact told. . . . More economies of operation, better price for producers, better year-around service for customers among advantages. . . .

ACTIVITY.—Crude production averaged 6,143,580 bbl. daily for the week ended December 15, down 1,045 bbl. daily. . . . ¶Total completions for the week increased 87 wells to 945. . . . Wildcat completions totaled 219 wells compared with 228 for previous week and 172 for same week last year. . . . ¶Rotary rigs operating in the United States on December 10 established another record at 3,021 rigs, up 614 from same date in 1950. . . .

TRENDS.—Indicated refinery demand for four major products in 4-week period ended December 8 was 13.6 per cent greater than in same weeks last year. . . . ¶The drop in major product stocks was 28.1 per cent greater. . . . Major product production was up 12.9 per cent. . . .

Spraberry Grows Up

Vast West Texas trend, with 800 wells completed and 120 new ones added monthly, is assuming some definition

Roy F. Carlson

MIDLAND, Tex.—The Spraberry Trend area is still growing, but it is beginning to assume some of the aspect of maturity.

An engineering committee has been formed to bring some order into the myriad of facts known about the Spraberry and to correlate any future information about the trend. *(The Oil and Gas Journal, December 13, 1951, page 65).* Development too is showing signs that the field is getting older.

Such a tremendous number of wildcats were drilled in past months that a large group of widely spaced "fields" was brought in, indicating that the field itself would be tremendous. Now, however, with much of this area being assumed as productive, drilling between these fields is regarded much as infill drilling would be in other fields.

In order to be regarded as a wildcat now, a Spraberry tester has to almost be out of the trend. The Texas Railroad Commission has adopted the policy in the trend of placing a wildcat in the field nearest the discovery well. The new well, however, is given a discovery allowable if it is a wildcat by definition.

800 wells completed.—With about 800 wells now completed in the Spraberry formation cumulative-production figures are rapidly rising, and now new wells are being added at a rate of 120 per month or more, and are boosting the production rate upward even faster.

PIPE LINES HANDLING SPRABERRY CRUDE

Company and fields—	Volume (Oct.) (bbl./day)
Plains Pipe Line Co.—Tex-Harvey, Aldwell, Driver, Germania, Midkiff, Pembrook, North Pembrook, Weddell, Weiner-Floyd	11,769
Tex-Harvey Pipe Line Co.—Driver, Germania, Pembrook, North Pembrook, Tex-Harvey, Weiner-Floyd	23,279
Gulf Pipe Line Co.—Driver, Germania, North Pembrook, Weddell	1,023
Shell Pipe Line Co.—Driver, Aldwell, Benedum, Pembrook, Weiner-Floyd	7,949
Sohio Pipe Line Co.—North Pembrook, Pembrook, Weiner-Floyd (delivered to main line)	487
Texas-New Mexico—Spraberry Deep	3,154
Phillips Pipe Line—Pembrook, North Pembrook (trucked to Shell Pipe Line)	212
Total	*1,466,063

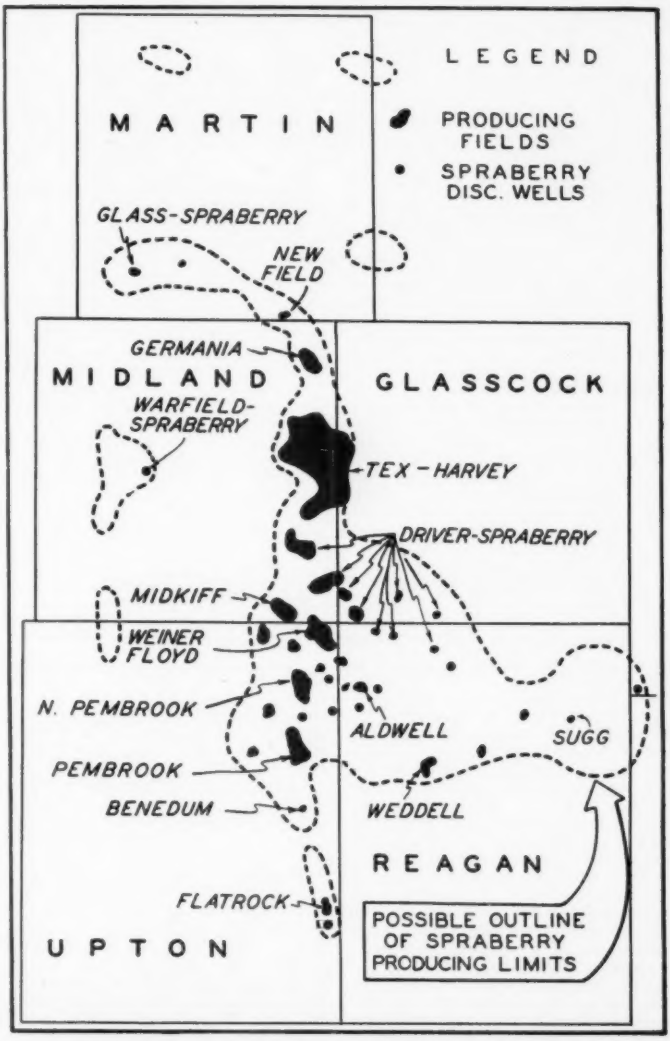
*58,714 bbl. additional moved by truck for use as drilling-in oil or other disposals.

Railroad Commission allowable production for the month of October approached the 2,000,000-bbl. mark, a figure which will probably be exceeded in the near future.

Over 200 rigs.—To reach the 120 or so completions per month, well over 200 rigs are being kept busy, 38 of these drilling wildcat wells as of December 1. By far the largest concentrations of rigs are in Tex Harvey and Driver fields, both having 50 rigs listed.

Tex Harvey leads in completed wells with 345, and the Driver area is second with 134. However, in the Four Corners area where Midland, Upton, Reagan, and Glasscock counties meet—also the location of much of the Driver field drilling—more than 250 wells have been completed.

Tex Harvey leads.—Tex Harvey field,



SPRABERRY AREA.—Map of the Spraberry trend of West Texas.

JOURNAL'S LATEST SPRABERRY TREND ROUNDUP†

Field and county—	Well summary, 12-1-51				Production				
	Drlg.	Completed Total	Completed Flow	Completed Pump	No. wells	Oct. allow.	Oct. prod.	Per cent of Oct. allow.	Cum. Nov. 1
Aldwell, Reagan	1	6	5	1	5	15,516	4,438	29	14,251
Driver, Midland-Glasscock-Reagan	50	134	124	10	79	257,062	228,259	89	560,075
Flatrock Spra., Upton	1	3	3	0	2				11,040
Glass Spra., Martin	1	2	1	1	1	2,542	1,237	49	12,636
Germania, Midland	4	48	44	4	42	132,220	93,380	71	609,294
Huddle-Manning	0	1	1	0	1	3,100	2,212	71	25,697
Midkiff, Midland	14	24	19	5	18	46,935	44,017	94	142,749
Pembrook, Upton	16	54	40	14	63	157,076	111,225	71	514,641
Pembrook (North), Upton	26	44	37	7	40	94,304	84,565	90	190,061
Smith Spra., Dawson	1	2	0	2	2	6,361	1,836	29	30,185
Spraberry Deep, Dawson	0	37	19	18	36	98,850	94,651	96	1,440,605
Tex-Harvey, Midland-Glasscock	50	345	316	29	313	907,984	740,769	82	4,363,894
Benedum Spra., Upton-Reagan	9	31	24	7	30	70,442	60,068	85	176,815
Weiner Floyd, Midland-Upton-Reagan	17	39	38	1	34	90,359	75,913	84	194,809
Weddell, Reagan	2	10	6	4	9	11,535	8,494	73	18,411
Warfield Spra., Midland	0	2	1	1	1				
Snowden, Spra.	0	4	1	3	3	8,773	3,149	36	23,903
Total	*192	786	679	107	679	1,903,059	1,554,233	82	8,329,066

*Not included are 38 wildcats—2 in Borden, 4 in Dawson, 5 in Glasscock, 3 in Midland, 18 in Reagan, and 6 in Upton counties. †Not considered in totals are North, East, and South Gail fields, Dawson County, all 1-well pumping fields.

being the oldest and the largest field in the trend, also leads in cumulative production. Spraberry Deep field, usually not considered as a part of the trend proper but as old as Tex Harvey field, has the second-highest production history. It also has the distinction of producing the closest to its allowable figure of all the Spraberry fields.

Outlets.—Spraberry crude is handled by a number of pipe-line carriers, the largest part through Tex Harvey Pipeline Co.'s system (Ashland Oil & Refining Co.). Second largest gatherer of Spraberry crude is Plains Pipe Line Co. Tex Harvey carried 23,279 bbl. daily during October, while Plains carried 11,769 bbl. daily during the same month.

Total crude movement from Spraberry leases during October was 1,524,777 bbl. This figure includes oil produced but not necessarily entering pipe lines since part of it went to other leases for drilling-in purposes. A portion of it is also trucked out of the area. These uses accounted for 58,714 bbl. for the month.

The largest part of the crude moving out of the Spraberry by pipe line now goes to the Mid-Continent area with the remainder going to the Gulf Coast. However, two large crude lines have been scheduled to move more West Texas crude, Spraberry oil included to the Gulf.

"Ifs" Worry Operators

Production in future dependent on steel supply, minimum controls, present-level taxes, and depletion allowance

ABILENE, Tex.—If shortages of steel products do not become too acute, if already excessive taxes do not rise higher, if the incentive of the depletion allowance is not removed, and if government controls do not choke the industry, West Central Texas will continue its important contributions of essential oil supplies.

Exploration for new oil in the area is proceeding at a high rate and secondary-recovery projects have been started and others are under active consideration to expand reserves in already proven areas.

Members of the West Central Texas Oil and Gas Association at their annual convention here were told that Stonewall County, one of 19 considered to be in West Central Texas, will soon become one of the major producers in the area. In 18 months, 18 new separate fields have been discovered, bringing the county's total to 21. The most important of these, according to C. S. Noland, of Skelly Oil Co., Abilene, is Katz field, where some 40 wells have now been drilled.

New life.—Older areas are being given added life through water-injection plans. Two of these floods were described by engineers, one in Reddin field, and one in Kirk field. The injection of water into the Lower Hope lime of Reddin field has already been responsible for recovery of 375,000 bbl. more oil than would have been possible by primary depletion.

Total cost of the injection system has been less than $100,000, according to James E. Russell, reservoir engineer of the field's operators committee. Another 350,000 bbl. will be recovered before the reservoir is exhausted of oil. A sandstone water flood is to be started in this field in the near future, calculated to recover an additional 1,000,000 bbl. from the Flippen sand.

Failure a success.—In the Kirk field flood of the Marble Falls limestone, an economic failure on the basis of primary recovery was turned into a profitable venture by water injection. Primary recovery was estimated to be 243 bbl. per acre or 5.75 per cent of the oil originally in place in the reservoir. Water flooding will recover an additional 22.7 per cent of the oil in place, according to P. S. Ervin, Tyler consulting engineer. The net profit to date from this flood is $253,775, with the total income from the flood being calculated at $506,775.

Walter M. Wilkinson, Sohio Petroleum Co., Abilene, described the Spraberry trend of West Texas as a large triangularly shaped area containing at least 488,000 acres where production can be obtained without fear of a dry hole. Some 800,000 acres could prove productive, he said.

Oil for '75.—Lt. Gen. Ernest O. Thompson, describing "Oil for 1975," predicted that in that year oil consumption will be at a rate of 12 to 14 million barrels per day. This will be obtained, he said, from new discoveries, better recovery methods, secondary recovery from old fields, increased use of butanes and propanes, conversion of gasoline from natural gas, and imports. Imports are necessary, he said, in order to build up reserves of oil domestically, to maintain a larger flexible tanker

fleet that is absolutely necessary for defense, and to supplement supplies of some products.

The association heard a report on the need for a new unitization law in Texas. It suggested that some method of compulsory participation in a unit plan should be included in such a law, but the law should also include protection for the small operator who is not financially able to bear the financial burden of such a plan. The report stated that many needed secondary-recovery projects have been blocked in Texas because of refusal of a small minority interest in the field to join in the plan. The report was accepted for further study by association members.

New officers.—Lester Clark, independent oil operator from Breckenridge, was elected president of the association succeeding French M. Robertson, Abilene independent. Vice presidents are E. M. Funkhouser, Woodley Petroleum Co.; and G. P. Crutchfield, Abilene, Tex., oil man.

INDUSTRY AFFAIRS

Gas Revolution

Growth in underground-storage projects resulting in more economical operation, higher price for producers

Henry D. Ralph

LITTLE ROCK.—The rapid growth in the development of underground storage is bringing a near revolution in the natural-gas industry, but many problems, both legal and operational, beset this development.

How to overcome these problems and what the trend means to producers and distributors alike was the principal topic of the winter meeting of the Interstate Oil Compact Commission here last week.

The commission's legal and engineering committees joined in the symposium presided over by Dean D. H. Carson of the University of Oklahoma School of Petroleum Engineering and conducted by four industry men with much experience with underground storage: Carl Cloud, of Oklahoma Natural Gas Co., Tulsa; Charles Hoffman, of Cities Service Gas Co., Oklahoma City; Dan O. Howard, of Warren Petroleum Corp., Tulsa; and Max Ball, consulting geologist, Washington.

Underground-storage reservoirs now or shortly to be in operation will store close to one-sixth of the total annual production of natural gas in the United States, these experts agreed. This brings great economies in the operation of a gas system, helps to increase the price of gas to producers, provides a more stable market, and increases conservation. But any suggestion that underground storage might be used to "hoard" gas for a long-term price rise was pooh-poohed as ridiculous.

The carefully prepared panel discussion was divided into nine subjects and developed these main points:

1. Why storage?—Increasing quantities of so-called distress gas are becoming available in relation to the volume of dry gas which formerly formed the chief supply for transmission lines. This distress gas is produced with oil and must be produced every day, whereas dry gas fields can be virtually shut in during the summer months.

Underground storage permits gas lines to purchase this oil-field gas which otherwise would be flared and to store it against winter demand. Some companies can use distress gas up to 90 per cent of their annual purchases if they have adequate underground storage.

Natural-gasoline plants have elaborate gas-gathering systems and yet are forced to flare much of their residue gas for lack of a year-around market. Last year more than one-third of all gas produced was oil-well gas, and about 11 per cent of total United States gas production was flared for want of market. One natural-gasoline company is considering the construction of its own underground storage near plants which have no pipe-line outlets or where the market is seasonal, with a view to storing the gas until market outlets are developed.

Benefits to producers are just beginning to be realized. Benefits to transmission systems are obvious, particularly where the storage is at the distribution end of the pipe line. Adequate storage permits a line to operate at close to 100 per cent load factor at all times with all of the gas going to the high-priced space-heating uses and none of it going to "dump" or industrial uses on interruptible contracts at low prices. Storage near the distribution end sufficient to handle about 30 per cent of a line's annual throughput will enable 100 per cent of the gas to be sold for highest-price uses.

This is creating a revolution in the economics of the natural-gas industry. The resulting economies can be made to extend back to and include the producer of gas, because the companies can afford to pay more for gas without raising prices to consumers. This is an important factor in the trend toward higher field prices for natural gas.

Underground storage at the field end of a transmission line is just now receiving serious study, and it promises to do much toward providing a steady market for gas now flared.

2. Best locations.—The most desirable location for an underground-storage reservoir is as close as possible to a large consuming market. Some successful and economic storage reservoirs are as far as 140 miles from a market, and a distance of 200 miles or more might be satisfactory.

"Floating" storage on a line some distance from a market is proving a great advantage on some systems if the gas can be fed out of storage without recompression. Such a reservoir is kept fully on the line at all times and acts as a surge tank or cushion. The constant turnover of the gas in storage permits great flexibility in operation of the system.

A big growth is now expected in the development of underground storage at the field end of transmission lines. One large interstate transmission company is already actively engaged in hunting suitable reservoirs in Texas, since much of its gas is produced in conjunction with oil. Such storage will provide a wider market for casing-head gas and the residue of natural-gasoline plants.

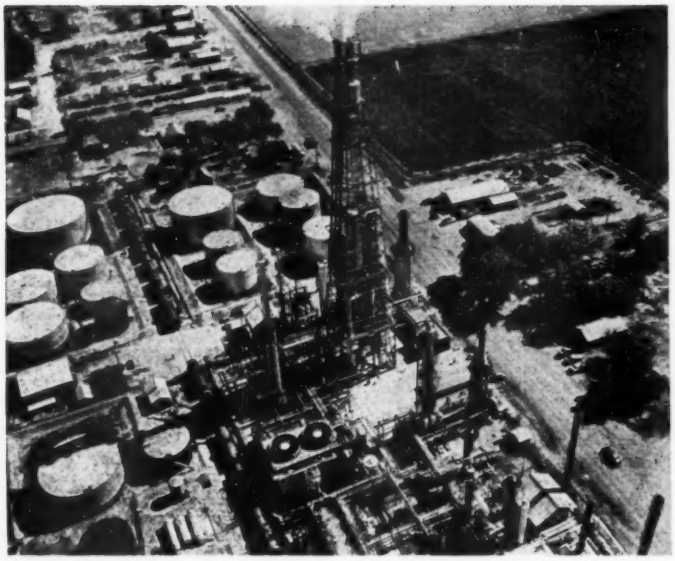
3. Characteristics of storage.—A storage reservoir must be completely gas-tight, a safe and sound underground trap. About two-thirds of those now in use are structural traps, closed anticlines, and the remainder are briefly stratigraphic traps sealed by pinchouts.

High permeability of the reservoir sand is important. Low permeability increases the compression required, and reduces the capacity and deliverability of the storage. Depth is also a factor, as the deeper the sand the higher the pressure and the greater the compression required for gas input.

The amount of gas required for the so-called cushion is also important, for the cushion gas kept in the reservoir represents capital permanently invested without a return. The amount of cushion required is fixed by the deliverability needed to meet a late-winter peak load, and by the base pressure required to prevent water intrusion.

Most underground storage now in use consists of depleted gas fields. Old oil fields may be used, but usually some residue oil is produced along with the stored gas and the separation of the oil raises problems which most gas companies prefer to avoid.

Some storage is now being devel-



Packaged Unit on Stream

A new 6,000-bbl. per day packaged T.C.C. unit has been placed on stream at New Mexico Asphalt & Refining Co.'s Artesia, N. M., plant. New facilities include a feed-preparation section, catalytic cracking section, fractionation, gas plant, and a catalytic polymerization unit. Charge to the feed preparation section consists of whole crude and reduced crude from an existing topping unit. The T.C.C. unit has a nominal fresh-feed capacity of 6,000 bbl. per stream day of gas oil, operating at about 55 per cent conversion level. The cat poly unit utilizes commercial liquid phosphoric acid as catalyst. Constructed by Southwestern Engineering Co., Los Angeles, the packaged-type construction was achieved through shop fabrication of all component parts. A novel feature of the new unit is the use of an oil-well derrick as the supporting structure for the catalytic section.

oped in water sands which have never held oil or gas, and this type of storage may become common in the northeastern states. Here the gas compresses the water without actually displacing it, and forms a bubble-type storage on top of the water.

4. How to find structures. — Water sands can be located by the orthodox geological and geophysical methods and tested by core drilling. The advantage of a depleted gas field is that its location is known and it is known to have been gas-tight originally.

In selecting an old field it is necessary to study all well logs on file to determine the nature and extent of the formation and the location and condition of old wells. However, this is not enough, as well logs are not always complete and accurate. It is advisable to search the records of well-service companies and to talk with drillers and producers to get all possible information about the old wells. In chosing between two possible fields an important factor is the estimated cost of locating and replugging all old wells.

5. How to procure.—Getting an adequate title is one of the most difficult problems in establishing underground storage. It is necessary to obtain a lease on the entire area, including marginal areas, without any breaks in the acreage, and there are usually some property owners who hold out.

In a water sand, the storage right is purchased in fee, plus the right of access on the surface. In a depleted oil or gas field it is necessary to obtain four rights: From the surface owner, from the royalty owner, from the mineral lessee, and the storage rights. The usual document is a standard oil and gas lease with a storage clause added. It is customary to buy back all royalties which have been separated from the surface ownership and to give or trade them back to the surface owners, since it is felt that all payment for storage rights should go to the landowner.

In some cases a storage field has been operated without obtaining rights from all surface owners and the hold-out landowners have drilled and produced and sold gas which had been injected for storage. In some states the courts have ruled that the landowner was entitled to this gas under the rule of capture, even though it was not under his land originally.

This situation has led to condemnation statutes in a number of states, giving the right of eminent domain to a company establishing an underground storage reservoir, and a federal condemnation bill is pending in Congress. Oil and gas producers have opposed such statutes on the ground that they might permit confiscation of an undepleted field, and they have had so many safeguarding provisions written in that some of these statutes are almost unworkable. Most producers take the view that if there must be condemnation it should be under state action rather than federal.

6. Conditioning the structure.—It is imperative to locate every well ever drilled into the structure selected, and this cannot always be done, from well-log records alone. Certain wells may be selected for injection, withdrawal, and observation uses, and the rest must be replugged.

Every well in the field must be reworked, as the old plugs cannot be assumed to be tight enough to hold the contemplated pressure. Very often some of the old wells will be under buildings, in the middle of a road, or converted to water wells, and this involves added delay and expense.

Every well must be redrilled below the bottom shown on the original log in order to make sure there will be no leaks. Very often a well is drilled into the formation below the storage sand and cemented from top to bottom. Old wells are often full of scrap iron and fence posts, or when casing was pulled a few collapsed joints were left in the hole. Such junk causes the drill to whipstock and makes reworking very difficult. In one case it took 6 months and $90,000 to replug one such well.

In locating injection and withdrawal wells, the system should be designed for expansion and with regard to the degree of compression required. A number of pressure-observation wells should be footed in sands above and below the storage sand.

7. Physical facilities.—Provision must be made to scrub and clean the gas before injection so as not to plug the face of the sand around the injection wells. This is very important, as early projects permitted cylinder oil from the compressors to get into the formation and it was necessary to rework and shoot the wells.

The trunk lines, compressor station, and field gathering system should be designed for the maximum rate of input or withdrawal anticipated. There should be a central master metering station to measure input and withdrawal of the entire field, as well as individual meters on each well.

The compressor station for a storage field is much more complex than for gas transmission, because the compression ratio is not constant but fluctuates constantly. The starting cycle is very low, but often two-stage compression is required to attain the maximum pressure. It is a very difficult problem of engine design to meet these requirements with the full utilization of horsepower.

8. Operation and maintenance. — Basically a storage field is operated like a gas field but with the added factor of injection. Therefore the compressor station must be more flexible and more completely manifolded, since the field may alternate between input and withdrawal several times during a single day.

A storage field should be operated as a full-floating system with all the wells wide open all the time, rather than by adjusting valves on individual wells. Therefore the gathering system must be designed and adjusted so that the pressure will be approximately the same over the entire system in order to avoid overworking weak wells.

A constant watch must be kept on the volume-pressure relationship. The amount of gas moving per pound of change in pressure will show how the field is operating. There will be minor fluctuations, but any big change over an extended period is a sign of trouble, and means either that the field is leaking or is being plugged up. Pressure readings should be taken daily from observation wells scattered throughout the field.

9. Magnitude and trend.—Some figures show that in 1948 there was underground gas storage for about 206 billion cubic feet of gas, but a survey in 1949 showed 81 fields with combined storage capacity of 500 billion feet. An informed guess is that storage fields now operating or in process of construction have a capacity of a trillion cubic feet. Production of natural gas in the United States in 1950 was 6 trillion, 892 billion cubic feet, so storage space is less than one-sixth annual production.

It is absurd to suggest that transmission companies might remove the bulk of southwestern gas and store it for years near points of consumption because of the expense involved, as underground storage costs from 10 cents to 60 cents per M.c.f. of capacity. The maximum amount of storage any transmission company desires or can afford is that which will permit it to operate its trunk line at capacity all summer and yet permit the storage reservoir to be drawn down completely by the end of the heating season.

Underground storage of gas is increasing just as rapidly as suitable storage fields can be located and prepared, but still the growth is not as fast as the growth in potential markets for natural gas.

Oil Control—A State Job

Responsibility for regulation of oil industry lies with producing states themselves, governors say

LITTLE ROCK.—Governors of oil-producing states consider it their responsibility to regulate the operation of the petroleum industry in such a way that the nation will always have ample supplies of oil and at the same time achieve the greatest amount of conservation.

They exchanged their views, in person and through official representatives, at the winter meeting of the Interstate Oil Compact Commission here December 11-12. The chief problems of the coming year, as seen by the governors, are these:

- Build up a reserve capacity for producing crude oil as a cushion for emergency demands.
- Promote unit operation of oil pools, by compulsory unitization laws if necessary.
- Assist operators in acquiring underground storage fields for natural gas as a means of conservation and more complete utilization of flare gas.
- Preserve the statutory depletion allowance in the federal income tax as a means of providing capital for new discovery and development.

Thin margin.—Gov. Allan Shivers of Texas, outgoing chairman of the commission, declared that our excess producing capacity, while now slightly higher than it was 6 months ago, "remains a dangerously thin margin between 'just barely enough' and 'not quite enough.'" He reported the reserve capacity now as 510,168 bbl. per day *(see separate story in this issue)*.

Asks unit law.—Gov. Sid McMath of Arkansas, who was elected chairman of the commission for 1952, stressed the need for compulsory unitization laws, a movement in which his state pioneered.

"It is the duty of the states to keep their laws, rules, and regulations modern and up to date so as to take advantage of the newest technological developments in oil and gas production and conservation," he said.

"Our Oil and Gas Commission, keeping abreast of the engineering advances made by the industry, several years ago determined the most efficient way to operate an oil and gas reservoir was by maintaining the pressure in the reservoir. However, it also determined that the only way this improved method of production may be employed is through unitization of the pool and treating the reservoir as a unit.

"Today we witness a growing realization in the industry that ways to minimize the amount of oil left in the field are as important as discovering a new field. In other words, if we can double the recovery from an old field, it accomplishes the same result as the discovery of a new field of the same size and likely will be more profitable. We can only increase recovery through pressure maintenance. This is best accomplished through unit operation and in many cases it is impossible without unit operation.

"I sincerely believe that it is the responsibility of state legislatures and regulatory agencies to provide this means of operation to the operators so that some very, very small minority interests cannot block an operation that would add millions of barrels to our nation's production and reserve."

Land condemnation.—Gov. Edward F. Arn of Kansas used a similar theme to urge the enactment of state laws permitting condemnation of land for the underground storage of natural gas.

"We must recognize," he said, "that the tremendous progress made in developing new techniques for the production, transportation, and marketing of oil and gas must be reflected in modern regulatory laws and rules. Static regulation of dynamic industries, by the very nature of things, just won't work. It is our obligation to subject our oil and gas-conservation laws to continuing analysis. They must be kept abreast of the results of industry's continuing research.

Example cited.—"Among the most recent examples of state regulatory laws advancing with the technology of the industry is the act passed by our last legislature permitting the condemnation of underground storage for natural gas. The bill is a model of fairness to the landowner and condemning utility alike.

"Its benefits are substantial to the gas utilities, transmission companies, producers, and, of course, to regulatory authorities. Gas utilities have a new way open to them to secure firm wholesale supplies. New transmission facilities will be engineered and built at less cost per M.c.f. delivered because of this new factor which will make more efficient use of pipe-line capacities possible.

"Producers will enjoy greater stability as the seasonal factor is gradually eliminated. Regulatory authorities will have less of their time taken up with overproduction and underproduction as the full utilization of storage tends to lend uniformily to daily withdrawals."

A vital tool.—Clarence T. Smith of Flora, Ill., long a member of his

state's representation on the Compact Commission, delivered a featured address on the theme that statutory depletion is a vital tool in conservation.

The fact that the nation's production and reserves are constantly increasing without excessive prices to consumers is due, he said, to tax treatment which permits the replacement of capital used in exploration and development. He continued:

"Conservation is essential if the purpose of statutory depletion is to be realized. The full present deduction is essential if conservation is to be accomplished. The two—conservation and statutory depletion—are related. One is dependent upon the other.

"Oil and gas must be found before it can be conserved. To find more oil and gas, history has demonstrated that we must have statutory depletion—because depletion provides a practical and well-tried method of recognizing and compensating for the hazards of the industry.

"It is only a sound and economically healthy oil and gas industry that can discover more oil and in the process of discovery, development, and production thereof, properly produce and conserve the same."

New producing states? — A forecast that other oil-producing states may soon join the 20 member and 2 associate member states in the Compact Commission was made by Governor Shivers. The Little Rock meeting was attended by observers from the nonmember states of North Dakota, Utah, Nebraska, and California, and the Territory of Alaska. An international flavor was given by the presence of two officials of Venezuela as special guests.

In addition to electing Governor McMath as its chairman for the coming year, the commission chose Jeff A. Robertson, chairman of the Kansas Corporation Commission, as first vice chairman, and G. E. Eddy, head of the Michigan Department of Conservation, as second vice chairman.

Oil-Well Capacity

Shivers says 510,168 bbl. daily additional possible

OIL wells of the United States have the capacity to produce 510,168 bbl. per day more than they are currently producing, according to a survey announced by Gov. Allan Shivers of Texas.

This compares with a reserve producing capacity of 1,139,927 bbl. per day available in August 1950, and with 429,173 bbl. per day last April.

The survey was made by the Interstate Oil Compact Commission and was announced by Shivers at the meeting of that body in Little Rock last week. However, he called attention to the fact that the first two surveys included only Compact states whereas the latest survey includes the entire country, and that half of the increase above the April figure is accounted for by the inclusion of one nonmember state, Wyoming.

The states reporting reserve producing capacity are shown in the accompanying table.

Texas' activity.—In presenting the figures, Shivers noted that Texas, which claims 76 per cent of the excess producing capacity, has kept up only through unparalleled drilling activity.

"In the first 9 months of 1951," he said, "Texas drilled 11,814 wells, 1,304 more than in the corresponding period last year. Our production for the first 9 months was 733,503,257 bbl. of crude, 24.9 per cent over the 1950 rate and an indication that for the first time we may exceed the billion-barrel mark in 1951."

At the same time in Austin, Chairman Ernest O. Thompson of the Texas Railroad Commission released a breakdown of the reserve producing capacity in that state, also shown in the accompanying table.

RESERVE PRODUCING CAPACITY. DECEMBER 1951

State—	Barrels per day
Colorado	6,000
Kansas	30,500
Louisiana	15,000
Montana	500
New Mexico	30,000
Texas	388,168
Wyoming	40,000
Total	510,168

TEXAS RESERVE CAPACITY

	Barrels per day
Dist. 1 (Southwest Texas)	1,358
Dist. 2 (Southwest Texas)	33,973
Dist. 3 (Gulf Coast)	73,928
Dist. 4 (Southwest Texas)	29,590
Dist. 5 (East Central Texas)	16,040
Dist. 6 (East Texas, outside)	54,196
Dist. 6 (East Texas field)	17,996
Dist. 7-B (West Central Texas)	6,516
Dist. 7-C (West Central Texas)	13,973
Dist. 8 (West Texas)	130,177
Dist. 9 (North Texas)	10,403
Dist. 10 (Panhandle)	18
State total sustained reserve producing ability	388,168

Microwave Fracas Eased

HOUSTON.—An interim agreement has been reached between Bell Telephone Co. and two major pipe-line firms which provides for the interconnection of Bell facilities with microwave-communications systems owned by the pipe-line companies.

The companies involved are Transcontinental Gas Pipe Line Corp. and Humble Pipe Line Co. They, due to the rapid growth of their microwave systems, are the first to confront a problem involving use of Bell switchboards and communication lines for transmission at terminal points of messages coming over industry microwave systems. The telephone company has consistently objected to connection of their facilities with other communications systems.

The interim agreement is subject to revision after January 9 when a final hearing will be held before the director of the Houston Public Service Commission. However, an appeal to the courts may be expected no matter how the commission rules, because of the precedent which the case will set. Bell officials have stated that the company's policy elsewhere in the country will be based on the nature of the agreements made with Houston companies.

BAIRD H. MARKHAM

Markham Honored

Long-time A.P.I.C. chief retiring on December 31

NEW YORK.—Baird H. Markham, chief executive of the American Petroleum Industries Committee of the American Petroleum Institute since it organization date in 1933, will retire December 31 under the Institute's retirement program.

Markham, who will continue to serve as an A.P.I. consultant, was honored last week by members of the committee and other A.P.I. and industry officials at a dinner at the Waldorf-Astoria Hotel.

Oscar John Dorwin, vice president and general counsel of The Texas Co., and presiding chairman of the A.P.I.C., said the petroleum industry "has been singularly fortunate to enjoy the services of one of the most capable organizers in the United States, a man of vision and exceptional integrity, a man we can always be proud to say was one of us."

Tribute paid. — Other tributes came from W. Alton Jones, president of Cities Service Oil Co., Inc., and former chairman of the board of the A.P.I.; L. S. Wescoat, president of Pure Oil Co. and present chairman

of the board; Frank M. Porter, A.P.I. president; Harry T. Klein, president of The Texas Co.; Edwin S. Hall retired vice president and general counsel of Esso Standard Oil Co.; P. C. Spencer, president of Sinclair Oil Corp.; George V. Holton, chairman of the board of Socony-Vacuum Oil Co., Inc.; and Roy T. Osborn, retired general counsel of Sinclair Refining Co.

Markham entered the oil business with the public and industrial-relations department of the old Marland Oil Co. in 1927. Shortly thereafter he was made assistant general manager of Marland and later was elected treasurer.

Following the merger of Marland and Continental Oil Co. under the latter name, Markham became controller and assistant to the president of the new firm.

While in Oklahoma, he served as president of the Oklahoma-Kansas division of the Mid-Continent Oil and Gas Association, adjutant general of the state, and commanding general of the 45th Infantry Division of the National Guard.

He is a graduate of Texas Christian University and Army War College.

Successor named.—John H. Bivins has been appointed A.P.I.C. director succeeding Markham. He joined the committee shortly after its founding in 1933 as assistant director, and was made an associate director about a year ago. He formerly was secretary of the Mississippi Petroleum Industries Committee.

Adam J. Rumoshosky has been appointed assistant director. He has been on the staff since 1927 as economist, administrative assistant, and manager of the publicity section.

Nonstaff changes in A.P.I.C. include: Cyrus S. Gentry, vice president and general counsel, Shell Oil Co., named to succeed Oscar J. Dorwin, The Texas Co., vice president and general counsel; Joseph P. Walsh, general counsel, Sinclair Oil Corp., named secretary succeeding Gentry; and Lloyd F. Thanhouser, vice president and general counsel for Continental Oil Co., and Rayburn L. Foster, vice president and general counsel, Phillips Petroleum Co., named new members.

WEST COAST

Washington Gets Producer

LOS ANGELES. — California no longer is the sole oil-producing state on the western seaboard. Last week it was joined by Washington when a gas-condensate producer was completed at Ocean City in Grays Harbor County.

The discovery was Tom Hawksworth Oil & Gas Development Co. 4 Hawksworth-State in 15-18n-12w. It was completed flowing 35 bbl. of 49°-gravity condensate and 300 M.c.f. of gas daily. The flow was made through a 1½-in. bean, with 1,000 psi. casing pressure and 900 psi. on the tubing being recorded. Production was from 126 ft. of fractured shale and sand in the Kincaid zone, possibly of Miocene age. The wildcat had been drilled to 3,714 ft., or 126 ft. into the Kincaid. *(The Oil and Gas Journal, November 15, 1951, page 207.)*

No. 4 State is located on a 20,000-acre block jointly held by Hawksworth and Los Nietos Co., a wholly owned subsidiary of Union Oil Co. It is expected that a second test will be started on the block in the near future.

ECONOMICS

Crude Imports Up

October saw 95,000-bbl. daily gain; exports drop

CRUDE and product imports increased and exports decreased in October, according to data compiled and released by the Census Bureau of the Department of Commerce.

Total imports into the continental United States averaged 815,000 bbl. daily, a gain of 95,000 bbl. daily, or 13.2 per cent, over September. However, the October average was smaller than for any month in the period from August 1950 through June 1951.

Starting with July of this year, imports were reduced by the program for diverting South American oil to Europe, following the shut down in Iran.

Crude imports changed very little from September with the drop in receipts from the Middle East balanced by a large increase for Venezuela. Crude from Venezuela totaled 9,999,942 bbl., the highest level since August 1950. Receipts from Colombia dropped slightly from the abnormally high level reported for September. A total of 114,000 bbl. of Canadian crude came in during the month.

IMPORTS INTO CONTINENTAL UNITED STATES
(Thousands of barrels)

	Oct. 1951	Sept. 1951	Oct. 1950
Crude—			
Mexico	1,115	1,145	1,017
Colombia	1,421	1,752	1,130
Venezuela	10,000	7,511	9,876
Kuwait	614	1,990	1,974
Saudi Arabia	890	1,485	1,499
Borneo	320	318	
Canada	114	75	
Total crude	14,474	14,276	15,496
Daily average	467	476	500
Products—			
Residual fuel	9,757	6,532	10,845
Other products	1,020	787	1,326
Total products	10,777	7,319	12,171
Daily average	348	244	393
Total all oils	25,251	21,595	27,667
Daily average	815	720	893

EXPORTS*

	1951 Oct.	1951 Sept.	1950 Oct.
Crude	1,947	2,199	4,033
Gasoline	3,526	4,019	1,814
Kerosine	755	1,325	135
Distillate fuel	2,376	2,554	1,108
Residual fuel	2,553	2,962	632
Lube oils	1,246	1,546	1,002
Other products	725	875	814
Total all oils	13,128	15,480	9,538
Daily average	423	516	308

*Excludes shipments to territories.

Seasonal increase.—The seasonal increase in imports of residual fuel accounted for the major portion of the total gain in imports. The average for October was 315,000 bbl. daily compared with 218,000 bbl. daily in September and 350,000 bbl. daily in October 1950. The October average for all other products was about 7,000 bbl. daily larger than in September.

Exports. — Total exports, excluding shipments to territories, averaged 423,000 bbl. daily in October, a decrease of 93,000 bbl. daily or 18 per cent. Crude and every major product contributed to the drop in October. The largest decreases were reported for gasoline, kerosine, and residual fuel.

ALASKA

Products Line Planned

A 600-mile products pipe line in Alaska is being planned by the Corps of Engineers, U. S. Army, to serve military installations in the vicinity of Fairbanks. Pipe of 8⅝-in. diameter is being considered, and construction is scheduled for next summer.

The new line will originate near the town of Haines, which is at the head of the Inside Passage about half-way between Juneau and Skagway, where it can be supplied by either tankers or barges. Skagway is the origin point for a smaller military products pipe line now serving the Fairbanks area. This line was part of the wartime Canol project and was designed to service the Alaska Highway from a refinery at Whitehorse, since dismantled.

The section of the line between Skagway and Whitehorse was reversed and is now used to feed the line paralleling the Alaska Highway from Whitehorse to Fairbanks.

The projected line will not follow the narrow-gage railway to Whitehorse but will head northwest from Haines and follow a highway to a junction with the Alaska Highway in Canada considerably west of Whitehorse. It will then follow the Alaska Highway back into Alaska and will extend westward to reach a number of airfields and military installations in the Fairbanks area.

Engineering consulting services for the line have been furnished by Fluor Corp., Los Angeles; and S. S. Smith, Shell Oil Co., New York, according to reports.

M-46 Revised

NPA liberalizes materials-procurement rules for small construction projects, production operations, and MRO

WASHINGTON.—Regulations for the procurement of controlled materials by oil and gas operators in the United States and Canada have been substantially revamped by the National Production Authority in a rewritten Order M-46, which is administered by the Petroleum Administration for Defense.

These important changes are included in the new order:

... **PAD Form 26LP** is made available for the procurement of line pipe for small construction projects, production operations, and MRO when total quarterly line-pipe costs for those uses is $5,000 or more. Issuance previously was announced by PAD *(The Oil and Gas Journal, December 13, 1951, page 63).*

... **Greater latitude** is given oil and gas operators in getting small amounts of controlled materials for small construction, production, or MRO, increasing from $25 to $100 the dollar value of delivery orders for controlled materials that require PAD approval.

... **"Production operation"** is redefined to exclude material used in a secondary-recovery production operation utilizing water or gas in which the total cost of materials and equipment is more than $300,000 or the materials needed will include more than 1,000 tons of steel or 3,000 lb. of copper and copper-base alloys.

... **"Line item"** is defined as the total quantity of any single entry on a delivery order.

... **Symbols** used by the operators in getting materials for use in Canada—G-6 for materials for a construction operation, and G-7 for all other materials—are written into the order.

... **Revalidating - allotments procedure** for controlled materials that cannot be placed in the quarter for which they are issued is revised.

Allotments for which an operator does not succeed in placing a delivery order by the end of the quarter for which they were made become invalid. However, the operator is given a 15-day period after the close of the quarter in which he may request revalidation of authorizations of materials other than well casing, tubing, or drill pipe.

Filing dates.—When various PAD forms used under the order must be filed are spelled out, as follows:

PAD-15, application for emergency use of tubing and casing, to be filed whenever a need for the materials arises.

PAD-17, application for casing and tubing needed for regularly programed drilling, must be filed on or before the first day of the third month preceding the calendar quarter in which delivery is required.

PAD-17DP, covering regularly programed needs for drill pipe, must be filed on or before the fifteenth day of the fourth month preceding the calendar quarter in which delivery is required.

PAD-17DPE, for emergency requirements of drill pipe, to be filed whenever an emergency arises.

PAD-26, covering materials for large construction projects, must be filed as far as possible in advance of the time priorities assistance is needed.

PAD-26LP, new form, must be filed on or before the first day of the third month preceding the calendar quarter in which delivery is required.

When 26LP applies.—The new 26LP form is for a third class of line-pipe requests established by the NPA order, and covers:

1. Requests for line pipe to be used in a large construction operation, which is defined as any one complete construction operation in which the total cost of controlled materials is $5,000 or more or which involves building any inclosed structure with a total material cost of $5,000 or more, for which PAD-26 must be filed.

2. Requests in which an operator's combined requirements for line pipe in any calendar quarter for maintenance, repair, operation, production, and small construction total $5,000 or more, for which PAD-26LP must be used.

3. Requests in which an operator's combined requirements for line pipe for the purposes enumerated in (2) are less than $5,000 in any quarter, for which either PAD-26LP or delivery orders that will be subject to PAD approval may be filed.

Quota raised.—The option for quotas for MRO material for administrative operations has been shifted from Schedule C of the original order to a new Schedule D, and the quota is raised from 100 to 120 per cent of the MRO material used for such operations in the calendar year 1950 without obtaining approval from PAD.

An operator may elect to establish:

1. A standard quota, which is on a quarterly basis and is 30 per cent of the dollar amount which was spent during the calendar year 1950.

2. A seasonal quota, which is 120 per cent of the dollar amount spent during the corresponding calendar quarter in 1950.

3. An administrative quota, to be applied for to and determined by PAD or, in Canada, the Department of Trade and Commerce, and is designed to provide relief where an operator was only in partial operation or did not operate at all in 1950 or has had such expansion operations since 1950 that neither the standard quota nor seasonal quota properly represents his demands for MRO material for administrative purposes.

Schedule C carries a list of items that may not be obtained through use of M-46 priority symbols. The list has been increased by the addition of chemicals generally, paint, lacquer and varnish, and packaging materials and containers.

No Scrap, No Priorities

WASHINGTON.—Priorities for the replacement of oil and gas equipment will hereafter be contingent upon sale of the replaced equipment for scrap, under a policy adopted by the Petroleum Administration for Defense.

The new policy was announced by Deputy Administrator Bruce K. Brown as a means of getting the oil and gas industry into the scrap drive which is being waged by the Government. The need for increased scrap supplies is urgent if steel production is to be maintained, he said, and while the oil and gas industry is not normally a major source of scrap it is imperative that every ton it can develop be moved to the steel mills. As one of the major users of steel the industry should make every effort to aid in the campaign.

To bring industry scrap out, Brown said that in approving major projects involving purchases of controlled materials PAD will seek assurances that scrap from replaced equipment will be released.

"PAD always has given priorities assistance on a determination of how essential a proposed project was to needed expansion of the supplies of oil or gas," Brown said. "Now we face a situation in which we must also take into consideration what the project may be able to contribute to the collection of needed scrap."

Tax Easements O.K.'d

WASHINGTON.—Two hundred projects in and for the oil and gas industry were granted certificates for accelerated amortization of $500,000,000 of a proposed $682,000,000 investment up to October 19.

A summary of activities under the facilities-expansion program compiled by the Defense Production Adminis-

tration shows that in the first 51 weeks of its application a total of 3,660 projects with an aggregate investment of $9,854,614,000 were certified. Applications filed during the period numbered 15,162, representing proposed investments of approximately $25,083,000,000.

A breakdown of the certificates granted the oil and gas industry shows 128 for refining facilities to cost $620,458,000 on which it was given accelerated amortization for $454,833,000; 2 for natural-gas facilities to cost $6,758,000 on which amortization was granted for $4,414,000; 13 for natural-gasoline facilities to cost $34,911,000, given $25,005,000; 4 for oil-field machinery and tools to cost $566,000, given $383,000; 2 for crude pipe lines to cost $1,241,000 given $921,000; 2 for natural-gas-transmission facilities to cost $580,000, given $343,000, and 49 for petroleum storage and distribution facilities to cost $17,933,000, given $10,676,000. Certificates also were granted on seven projects for sulfur facilities to cost $8,259,000, of which $6,651,000 was given fast write-off.

NPA Clamps on Controls

WASHINGTON.—The following orders have been issued by the National Production Authority:

M-91, December 10: Placing imported and domestic selenium under complete allocation.

M-92, December 11: Imposing inventory control on auto-wrecking yards to expedite the development of scrap iron and steel.

Revised M-46, December 12: Revising the priorities procedure for the procurement of controlled materials by domestic and Canadian oil and gas operators.

Dir. 2 to M-25, December 12: Requiring metal-can manufacturers to satisfy current demands for cans before filling carry-over requirements.

Amendments to Dir. 2 to M-11, Dir. 1 to M-5, Dir. 3 to M-1 and NPA Reg. 2, December 12: Providing preferential status for orders for controlled materials and component parts for the machine-tool industry.

Amendment to M-2, December 14: Easing controls on the use of rubber, effective January 1.

EASTERN

Pennsylvanian Test Plugged

The deepest well ever drilled in Pennsylvania has been completed dry at 12,343 ft.

It is the 1 A. Bennett of The Californita Co., drilled 2.6 miles south of La Porte in Sullivan County. At total depth, the well was in the Upper Ordovician. The company is preparing to make available geological data on the operation.

The test has been closely followed since it was a deep operation in virgin territory of eastern Pennsylvania. The California Co. has large areas under lease in eastern Pennsylvania. Its future plans in its exploration of this region are not known. *(The Oil and Gas Journal, November 9, 1950, page 58.)*

MID-CONTINENT

Sinclair Looks Ahead

Petroleum-research program, already extensive, will be greatly expanded, Spencer says; new Tulsa unit planned

WE live in a highly competitive world which is on the march, and this competitive spirit reaches its peak in these United States where we have a free-enterprise system, P. C. Spencer, president of Sinclair Oil Corp., New York City, told the Tulsa Chamber of Commerce last week.

In paying tribute to Tulsa and its attainment, Spencer said that eternal vigilance is the price of retaining and maintaining such a position.

"In my opinion," he said, "tomorrow's final scores on progress made by a municipal corporation like Tulsa, or by a private corporation like Sinclair, will be measured and determined to a substantial degree in terms of technological plants, facilities, laboratories, people, organizations, plans, and programs."

"The University of Tulsa may be called upon to undertake special projects for us," Spencer said. "It is a practical working arrangement between an industrial corporation and a modern institution of learning which we believe paves the way for other similar arrangements looking toward the accomplishment of beneficial results for the common good," he said.

To expand research. — Sinclair Research Laboratories, Inc., the Sinclair subsidiary which operates "one of the finest and most modern" petroleum-research laboratories, at Harvey, Ill., has decided to expand its research activities into the field of petroleum production and exploration, Spencer said.

"These new activities, together with the production-research efforts of Sinclair Oil & Gas Co., will be centered right here in Tulsa."

Raymond M. Carr, petroleum engineer with many years' service in the production department of Sinclair Oil & Gas at Tulsa, will be director of the new production-research laboratory.

Spencer reported that contracts had been let for alteration of two buildings on company-owned property in Tulsa to provide space for the initial home of the production-research group. The initial staff will total about 50, including geologists, petroleum engineers, mechanical engineers, geophysicists, and chemical engineers.

"From this modest beginning in the field of production research. . . . we anticipate substantial growth in the future and we envision much larger laboratories to take care of our needs in the years to come."

Anadarko Basin Strike

BEAVER, Okla. — The northeast flank of the vast Anadarko basin is receiving its greatest exploration impetus in 10 years as the result of a commercial oil discovery last week at a well drilled 2 miles north of here in Oklahoma's Panhandle. The test is Flynn Oil Co. 1 School Land, SE SE SE 35-5n-23eCM, which marks the first oil well for the county. *(The Oil and Gas Journal, December 13, 1951, pages 137 and 144, and pages 379 and 381 of this issue.)*

With 7-in. pipe set at 5,540 ft. and with open hole to 5,559 ft., the well flowed 70 bbl. of high-gravity oil through casing, blew off control head, and died. The well then swabbed 162 bbl. of 38.8°-gravity oil in the following 8 hours. Gas volume is estimated at 250,000 cu. ft. per day. Producing horizon is believed to be the Marmaton (Pennsylvanian) limestone.

The operator owns 1,058 acres in the vicinity of the well. The largest acreage concentrations in the area include Superior Oil Co. with 2,880 acres, Stanolind Oil & Gas Co. with 2,240 acres, Cities Service Oil Co. 1,600 acres, and J. M. Huber Corp., 1,440 acres. Other companies owning leaseholds nearby include Blake Oil Co., Champlin Refining Co., Clayton-Dyer Drilling Co., Kay County Gas Co., Gulf Oil Corp., Panhandle Eastern Pipe Line Co., Sinclair Oil & Gas Co., Sohio Petroleum Co., Sunray Oil Corp., and The Texas Co.

Operator has released the following geological markers: Top of Herington lime 2,500 ft.; Krider lime 2,570 ft.; Fort Riley lime 2,690 ft.; and Lansing-Kansas City lime series 4,570 ft. Elevation: 2,560 ft. (rotary bushing).

The Flynn well logged commercial-oil showings at a series of intervals starting at 4,771 ft. (202 ft. in the Lansing) down to 5,559 ft. (985 ft. below the top of the Lansing). Of the 10 drill-stem tests conducted, 5 in particular showed favorable production over a wide interval ranging from 4,771 ft. to 5,559 ft.

NEW WAY TO CONTROL FIRE.—Blazing tank of crude oil, left, shown just before air was injected in tests conducted at the Olean, N. Y., refinery of Socony-Vacuum Oil Co., Inc. With the company's new method of fighting fires, the blaze was under control within a few seconds and completely extinguished within minutes. The method features injection of air below the liquid level, and has proven extremely successful for controlling tank fires of low flash-point liquids.

Starving Oil Fires

Socony-Vacuum demonstrates new fire-fighting technique using subsurface air jet to reduce blaze-feeding vapors

George Weber

NEW YORK.—Subliquid-level injection of air, a radically different approach to oil fire fighting, has been proved a valuable new method of controlling or completely extinguishing tank fires of low flash-point liquids.

Proof of the unconventional fire-fighting theory was successfully demonstrated last month to numerous engineers and fire-control experts by Joe L. Risinger, safety supervisor for Socony-Vacuum Oil Co., Inc.

In a full-scale test, an open storage tank of burning kerosine was put out in 5 seconds. A crude-oil fire in the same tank was reduced to a point permitting observers to climb the ladder and kill it with mechanical foam applied manually at the tank edge. Observers admit to being impressed by the rapidity with which the fires were snuffed or reduced, and by the simplicity of the whole procedure.

Vapor reduction.—The method is based on a reduction of hydrocarbon vapors which feed an oil tank fire. In such a fire, the thin layer of liquid at the surface is heated by the combustion of overlying vapors. The heat causes further vaporization to support and extend the combustion. If the heated oil on the surface is displaced rapidly with cooler subsurface liquid at a temperature below the flash point of the product, the vapor supply is reduced, the combustible mixture above the liquid is thinned, and the fire starves out.

The principle is an old established one; only the approach is novel. Displacement of heated oil on the surface is brought about rapidly and effectively by the simple injection of air at low pressure at the tank bottom. This is done by using any of the conventional lines with which storage tanks are equipped. Air injected through such lines rises to the surface with entrained liquid which spreads quickly over the surface.

If the liquid is stripped of low flash-point components, the flame front retreats ahead of the cooler liquid, and the fire goes out when the surface is covered. This will happen with kerosine and heavier products.

Whole crude containing a gasoline fraction will not be completely extinguished by this method, since the flash point is lower than atmospheric temperature. The turbulence induced by injected air will, however, reduce the fire to a low level. This condition, say Socony-Vacuum engineers, can be maintained for a long period to prevent boil-over and to allow the use of extinguishing agents without the risk of slop-over or frothing.

Full-scale test.—The company tests of this technique were conducted in mid-November at its Olean, N. Y., refinery. A 30 by 30-ft. product tank was equipped with water-drawoff and product-discharge lines, a spider, a shell ell, and a special mixing nozzle. The sole addition to conventional equipment was an air compressor with lines connecting to the above tank facilities.

Kerosine.—The tank was filled to approximately three-fourths capacity with 100,000 gal. of kerosine (specifications in Table 1):

TABLE 1—KEROSINE

Gravity, °A.P.I.	47.4
°%Distillation:	
I.b.p., °F.	334
10 per cent	356
50 per cent	400
90 per cent	468
End point, °F.	522
Flash point, °F.	126
Pour point	Below 30
R.v.p.	0

Five burning tests were run on this project, using various lines and differing air-injection rates. Air injection was predetermined on an approximate basis by direct observation of turbulence on an unignited surface. Air pressure at injection points varied from 6 to 10 psig. Injection rates ranged from 40 to 90 cu. ft. per minute.

Injection was tried at points along the edge of the bottom tank area, and at the center of the tank. In other tests, air was injected through a perforated pipe extending across the diameter of the tank bottom, a perforated circumferential ring, and a perforated spider.

The most efficient injection point was, as expected, the tank center. From that point the rising current of cool kerosine, on reaching the surface, spread rapidly outward to the tank edges. Point injection at the tank edge also caused complete spreading of cooler product across the surface, but required more time.

Center injection extinguished the fire 5 seconds after air entered the liquid in the tank and required 6¼ cu. ft. of air. Injection pressure was 6 psig. In all tests, the kerosine was allowed to burn freely before air injection. All tests resulted in killing the fire.

Crude.—The same tank, similarly equipped, was used for tests using a Pennsylvania crude oil. This crude contained approximately 37 per cent gasoline (specifications in Table 2):

TABLE 2—CRUDE

Gravity, °A.P.I.	44.2
S.U.V. at 100° F.	35.04
Pour Point, °F.	Below 30
Flash point, °F.	Below 0
Distillation:	
I.b.p., °F.	132
10 per cent	248
50 per cent	450
78 per cent (cracked)	660

Six tests using various air-injection points and rates were conducted over a period of about 2½ hours. Since they were aimed at testing various methods for flame control and elimination of boilover and slopover, switches were made without extinguishing the fire in most cases.

Agitation by air injection through the spider resulted in good fire control, bringing flickering flames down to a height of about 12 in. and allowed personnel to observe the fire from the tank edge. Some water was used to cool the freeboard, stairway, and platform after brief periods of uncontrolled burning. Full burning was permtited for short periods only to prevent damage to the tank above liquid level.

Uncontrolled, the crude fire would cause a heat wave to travel downward through the liquid at the rate of 48 in. per hour, or 8 ft. 4 in. during the total burning time of the test. This heat wave, on reaching bottom water in a tank, is the cause of tank boilover. Heat-detecting paint on the tank showed no downward progress of the heat wave due to agitation of the liquid.

The fire was extinguished twice during the test, in each case with the burning rate controlled to a low point by agitation. Ten gallons of 3 per cent solution of mechanical foam, applied by inspectors at the tank edge, sufficed to extinguish the fire. When applied, the foam caused no frothing or expansion, engineers reported.

More experiments planned.—The success of these preliminary tank-fire tests has encouraged engineers to plan further experiments on a larger scale. They say the methods used successfully on the 30 by 30-ft. tank will also prove successful on much larger tanks and intend to demonstrate. Numerous variations in the agitating method including the use of carbon dioxide instead of air are also planned. The method will also be tested on a full-scale gasoline tank fire to determine how well such a fire can be controlled.

In presenting their findings, Socony-Vacuum representatives make it plain at the outset that they by no means intend to discredit present theories and methods for fighting oil fires. They feel, however, that even the limited extent to which this novel method has shown success fully justifies further study, and they present their findings to date for industry appraisal.

INTERNATIONAL

Aid to Venezuela

Country uses conservation practices set by Compact

PRINCIPLES of oil and gas conservation developed by trial and error over a period of many years in the United States are being applied with much greater ease by the Government of Venezuela.

How this is so was explained to the Interstate Oil Compact Commission in Little Rock by the first Latin American representatives ever to address that body: Jose Martorano-Battisti, minister counselor for petroleum in the Venezuelan embassy, Washington; and Eduardo A. Acosta, assistant to the chief of the conservation department of the Ministry of Mines and Hydrocarbons, Caracas.

As the second-largest oil-producing country in the world, Martorano said, Venezuela owes a debt of gratitude to the Compact Commission for developing conservation methods which have been applied in his country.

Lauds conservation.—"Since petroleum is the lifeblood of our economy we are determined to focus the central theme of our oil policy around conservation. We in Venezuela have watched with admiration the way in which your commission has worked to prevent physical waste in the production of oil and gas, and this has been an inspiration to us to follow as far as we can in your footsteps.

"Fortunately, the benefits of the advancement of the principles of oil and gas conservation, as introduced and promoted by your commission, have not been confined to the boundaries of the United States. These principles and practices, as well as the administration thereof, are finding their way into the oil-producing nations of the world, particularly in my country, with the result that we have been able to profit by your experience."

Landowners no problem.—In a comprehensive review of conservation activities in Venezuela, Acosta pointed out that the multiplicity of landowners and producers which characterizes the United States oil industry is not a problem in Venezuela because subsurface minerals are owned by the government and a single concessionaire operates a large area.

This has made it far easier to apply conservation methods, he pointed out, but even so until 1934 most reservoirs in Venezuela were operated without regard to proper technical procedures. Now, he explained, the Ministry of Mines and Hydrocarbons follows conservation practices developed in the United States and maintains a close working relationship and exchange of personnel with the Texas Railroad Commission.

Venezuela's chief problem in conservation of gas lies in the fact that there is very little market for gas which must be produced with oil, with the result that large quantities are being flared.

CANADA

Oil Trunk O.K.'d

Trans Mountain to build Alberta-Vancouver line

OTTAWA.—The Dominion Board of Transport Commissioners has awarded Trans Mountain Oil Pipe Line Co. the franchise for a pipe line to carry oil from Alberta to the Pacific Coast.

The planned 695-mile, 24-in. line will follow an all-Canadian route from Edmonton, Alta., through Yellowhead Pass in the northern Rockies to Vancouver, B. C.

It will carry 37,500 bbl. of crude per day initially, and capacity will eventually be stepped up to 75,000 bbl. per day.

Three drop out.—Trans Mountain was one of five pipe-line companies seeking a franchise for oil-transmission lines from Alberta to the Pacific Coast. Earlier last week, three of these companies, Westcoast Transmission Co., Independent Pipe Line Co., and Alberta Natural Gas Co., withdrew their applications. The fifth applicant, Champion Pipe Line Corp., previously secured an adjournment until the end of February 1952, on the indicated possibility that more than one oil line may be approved.

Estimated cost of the Trans Mountain line is $80,028,000, and completion is anticipated by 1953 provided a start is made early in 1952.

Coming Next Week . . .

Let's "Beat the Oil Experts!"—Here's your chance to try your skill on another of the Journal's periodic "oil and gas quizzes." You'll have another opportunity to enjoy this Journal "refresher course" quiz feature. Designed for about a 1-hour "checkup game," this Journal section will provide a sounding board to frame your $1 and $64 answers, in an end-of-the-year checkup on your oil knowledge and Journal readership.

PERSONALS

Vice President

Voorhies named to new post with Esso Standard Oil

H. J. VOORHIES, general manager of Esso Standard Oil Co.'s Baton Rouge, La., refinery, has been elected a vice president of the company succeeding Cecil Morgan who has been transferred to New York.

In this new post, Voorhies will be the company's chief executive officer in Louisiana in charge of manufacturing, public relations, and crude-oil-purchasing operations of the Louisiana division. He will continue as general manager of the Baton Rouge refinery.

Voorhies began his career with Esso in 1920 while attending Louisiana State University. During three summer vacations he worked at the Baton Rouge refinery as a paraffin plate shop helper and as a temporary clerk in the pipe-line department. In 1922 after graduating from L.S.U. with a B.S. degree in mechanical engineering, he was employed at Baton Rouge as a combustion engineer.

In 1929 Voorhies went to what was then the research laboratory as a chemical engineer. In 1932 he joined research process engineering, becoming head of that department in 1933. Later that same year he became head of the technical division.

He was appointed assistant to the general manager in 1935, assistant general manager in 1944, and general manager in 1949.

Cecil Morgan, vice president in charge of manufacturing, public relations, and crude-oil purchasing for Esso Standard Oil Co.'s Louisiana division with headquarters at Baton Rouge, has been elected to the company's board of directors. As vice president and director, he will assume increased responsibilities in the firm's New York office headquarters beginning January 1. Morgan joined Esso in 1936 as attorney in Shreveport, was named associate general counsel of Esso in 1945 with offices at Baton Rouge, and was elected vice president in 1949. He was graduated from Louisiana State University in 1919, was a member of the Louisiana legislature from 1928 to 1932, a state senator from 1932 to 1934, resigning when he was elected district judge, First Judicial District, Caddo Parish.

Charles R. Meissner, Jr., geologist for Gulf Oil Corp., has been transferred from Lewistown, to Billings, Mont.

Rex C. Cabaniss, exploitation engineer trainee for Shell Oil Co., has been transferred from Hobbs, N. M., to New Orleans, La.

H. B. Keck and **Frank Ittner,** vice presidents of Canadian Superior Oil Co. of California, Ltd., have been elected directors.

Frederick F. Tracy, production engineer for Gulf Oil Corp., has been transferred from Odessa to Crane, Tex.

Weldon E. Williams, formerly field engineer for Falcon Seaboard Drilling Co. at Shawnee, Okla., has joined Sunray Oil Co. at Victoria, Tex., in the same capacity.

James Grant, formerly assistant manager of the Stanlow, Cheshire, England, refinery of Shell Refining & Marketing Co., Ltd., has been made manager of the company's refinery at Shell Haven in Essex. Grant joined Shell as a chemist in 1927 and spent the first 11 years of his company service in the United States. He later filled refinery managerial positions in Egypt and Trinidad.

Thomas G. Rabbitt has been appointed general traffic manager of Sun Oil Co., succeeding **Porter L. Howard** who has retired. Rabbitt has had more than 34 years' experience in the Sun Oil traffic department and has served as assistant general traffic manager since July of last year.

G. S. Williamson, formerly assistant refinery manager at the Montreal East refinery of Shell Oil Co. of Canada, has been appointed superintendent of the new Shell Chemical plant now being built at Montreal.

J. L. Walker and **Max Passante,** formerly geologists with Carter Oil Co., have resigned to open offices at Denver as consulting geologists. Walker has had experience through Wyoming, Utah, and Colorado with Carter. Passante joined Carter's Rocky Mountain staff in 1949, following geologic work with Standard Oil Co. (N. J.) through foreign areas, including South America and Europe.

Dixon H. Cain, vice president in charge of drilling and production operations for Fifteen Oil Co., has been elected director and president of the firm filling the vacancy caused by the death of David M. Picton, Jr.

Jackson Collier, tool pusher for Cook Drilling Co., has been transferred from Haynesville, La., to Farmington, N. M., in the same capacity.

Jack Schafer, petroleum engineer for Atlantic Refining Co. at Midland, Tex., has resigned and joined DeGolyer & MacNaughton, geological consultants at Dallas, in the same capacity.

V. M. Pritchard, tool pusher for Penrod Drilling Co., has been transferred from Crane, Tex., to Hobbs, N. M.

R. J. Harwood, of Harwood Oil Co., has been reelected president of the Kansas Independent Oil and Gas Association, and **Pierce Musgrove,** of Musgrove Petroleum Corp., was reelected vice president of the association. **William S. Brunson,** of Brunson Drilling Co., was elected to a vice presidency after filling the office of treasurer during the past year. **E. B. Shawver** was reaffirmed in his office as lifetime vice president of the association. Shawver was the first president to be elected upon organization of the Kansas body. Other officers elected include: **J. F. Ralstin,** of D. R. Lauck Oil Co., secretary; **R. E. Mallonee,** of Mallonee Drilling Co., treasurer; and **Tom Orr,** executive secretary.

H. E. Hughes has been transferred to the engineering staff of Shell Chemical Corp. at Houston. He formerly was chief engineer of the company's chemical plant at Dominguez, Calif.

PERSONALS

Bill Bancroft, formerly with Sinclair Oil & Gas Co., has joined Texas Eastern Production Co. at Shreveport as assistant district geologist.

Richard W. Camp, vice president of Consolidated Gas Utilities Corp., has been elected president of the Oklahoma Utilities Association.

Dr. William E. Hanford, director of petroleum and chemical research for M. W. Kellogg Co., New York, has been elected chairman of the division of polymer chemistry, American Chemical Society for 1952.

I. W. Hartman, Mount Pleasant, Mich., independent producer, has been appointed to the state oil-advisory board to serve out the unexpired term to May 1952 of **Guy E. Chapman,** president of Chapman Oil Co. Chapman, who had served on the board since September 1948, resigned because his personal business required that he spend most of his time away from Michigan.

R. E. Smith, independent operator, president and director of the new Houston Petroleum Club, formally opened the new facilities atop the Rice Hotel last week. Other officers and directors present were: Vice President **L. F. McCollum,** president of Continental Oil Co.; Vice President **Virgil Brill,** president of Highlands Oil Co.; Secretary **Marlin E. Sandlin,** vice president of Woodley Petroleum Co.; and Treasurer **E. O. Buck,** vice president of the National Bank of Commerce. Directors present included: **Hugh Q. Buck,** partner in the law firm of Fullbright, Crooker, Freeman, and Bates; **David C. Bintliff,** independent; **Vernon W. Frost,** independent; **Fred J. Heyne, Jr.,** independent; **Ralph A. Johnston,** independent; and **Claude A. Williams,** president of Transcontinental Gas Pipe Line Co.

Ross Opie, Fargo, N. D., has been named president of the North Dakota Liquefied Petroleum Association, succeeding **Addison Hedberg,** of Parshall, N. D.

Hamlin Fox has resigned his position as district geologist for Union Oil Co. of California in the Arkansas-Louisiana-Texas area effective January 1 and has accepted a similar post with Superior Oil Co. at Tyler, Tex. Prior to joining Union Oil, Fox was associated with Tide Water Associated Oil Co. at Tyler.

Ernest W. Casagrande, formerly assistant superintendent of the Dominguez, Calif., plant of Shell Chemical Corp., has been named superintendent at Shell Point, Calif. **R. L. Kittle,** formerly superintendent of Shell's Torrance butadiene plant, succeeds Casagrande at Dominguez.

Walter Dreyer has been appointed vice president and chief engineer for Pacific Gas & Electric Co., and **K. C. Christensen** has been named treasurer of the company effective January 1. Dreyer will succeed **I. C. Steele,** vice president and chief engineer, who retires after 42 years of service, and Christensen takes the place of **E. J. Beckett,** treasurer, who is retiring after 36 years of service.

Harry Jarred has been named assistant district geologist for Natural Gas & Oil Corp. at Shreveport.

E. Constantin, Jr., prominent oil man, has been elected a director of the Mercantile National Bank at Dallas.

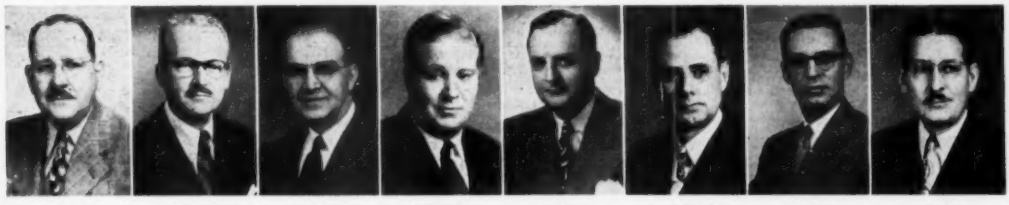
D. B. Vale, deputy manager of the fuel-oil department of Shell Petroleum Co., Ltd., in the United Kingdom, has been appointed manager of the department, effective January 1.

Dr. D. N. Wadia, geological adviser to the government of India, is visiting oil and mining operations in the United States as a guest of the State Department. He now is touring research centers and oil fields in the Mid-Continent and Gulf Coast areas under the auspices of Shell Oil Co. Dr. Wadia left India August 31, and will return to his country December 29.

W. B. Mitchell, technologist in the catalytic cracking department of Shell Oil Co.'s Wilmington, Calif., refinery, has been transferred to the company's main offices in New York. **R. B. Ewell,** formerly in the New York offices, is now at Wilmington where he is a senior technologist.

Chauncey Smith, superintendent at the Wichita compressor station of Cities Service Gas Co., has been transferred to the Straight compressor station in the same capacity. **George Arterburn,** superintendent at Straight, has been transferred to Wichita as superintendent.

Stanolind Elects New Board Members, Announces Other Changes



EVANS *THOMPSON* *CLARKE* *SCHEMPF* *YOST* *LINDEMAN* *ELIAS* *FINCH*

John R. Evans and **Leslie A. Thompson** have been elected new members to the board of directors of Stanolind Oil & Gas Co., effective January 1. At the same time six other changes will take place in Stanolind's Tulsa general office, and Central and Texas-Louisiana Gulf Coast division offices. **George W. Clarke,** now director of exploration and a board member, will be manager of the Central division in Oklahoma City, replacing **J. H. Forrester,** who was recently appointed manager of research for Standard Oil Co. (Ind.). All operations in the Central division, consisting of Kansas, Oklahoma, eastern Nebraska, northern Louisiana, and Mississippi, are under the jurisdiction of the Central division office at Oklahoma City. **F. J. Schempf,** who is now manager of the Texas-Louisiana Gulf Coast division at Houston, will succeed Clarke in Tulsa as director of exploration. The new division manager at Houston will be **F. R. Yost,** now manager of the producing department and a board member. The Texas-Louisiana Gulf Coast division is comprised of southern Louisiana and the southern half of Texas bordering on the Gulf of Mexico. **Frank Lindeman, Jr.,** now general superintendent of the producing department, will move up to manager of the producing department, and **Whitney M. Elias,** who is now chief engineer of the producing department, will succeed Lindeman as general superin-

PERSONALS

tendent. **Lewis W. Finch,** chief production engineer under Elias, will be advanced to chief engineer, producing department.

R. E. Beitman, resident geologist for Ohio Oil Co., has been transferred from Bismarck, N. D., to Powell, Wyo., as area geologist.

Dr. Charles L. Thomas, formerly director of research and development for Great Lakes Carbon Corp., has joined the research and development staff of Sun Oil Co. Dr. Thomas has spent most of his career with Universal Oil Products Co. where he worked on development of catalysts and catalytic processes for petroleum refining. For the past 6 years he has been with Great Lakes Carbon. He will move from Winnetka, Ill., to Swarthmore, Pa.

Walter C. Huffman has been appointed assistant director of the Petroleum Administration for Defense, Refining Division. Prior to coming to PAD in October 1950, Huffman was with Sun Oil Co. In his new position he will supervise the development of over-all materials requirements for the petroleum-refining industry and the distribution of materials for refinery projects.

Michael E. Murphy has moved to Tulsa as president of the new organization, Murphy Oil Co. of Oklahoma, Inc. The new firm is a producing subsidiary of Murphy Oil Co. of Pennsylvania. Others from the Philadelphia home office being transferred to Tulsa include: **Louis Bristol,** vice president in charge; **John C. Duffy,** treasurer; and **Thomas Everly,** secretary. The new firm will direct operations in Oklahoma, Texas, Kansas, and Indiana.

W. E. Bingham, junior mechanical engineer for Shell Oil Co. at Midland, Tex., has been transferred to Tulsa in the same capacity. Other changes in the firm include: **G. R. Christman,** junior mechanical engineer at Midland, transferred to New Orleans; **M. C. Connor,** junior exploitation engineer at Midland, now at Houston; **R. L. Geer,** junior mechanical engineer at Midland, to New Orleans; **J. J. Lawnick,** junior exploitation engineer at New Orleans, to Midland; **G. E. Mansfield,** junior mechanical engineer at Midland, to New Orleans; **W. R. Sittig,** junior exploitation engineer att Midland, to Tulsa; and **A. R. Torode,** junior geologist at Houston, to Midland.

Al Harmon, Tulsa, has resigned from the legal and land department of British-American Oil Producing Co. After 5 years with B-A, Harmon plans to operate independently in Tulsa and to devote most of his time to Rocky Mountain and North Dakota operations.

Paul V. Keyser, Jr., has been appointed general manager of domestic marketing for Socony-Vacuum Oil Co., Inc. He succeeds **Herbert Willetts** who recently was advanced to director in charge of domestic marketing. Keyser has been manager of Socony-Vacuum's lubricating department since 1947.

V. O. Henderson, formerly fire and safety supervisor for General Petroleum Corp., Los Angeles, has been advanced to assistant superintendent of the southern division's pipe-line department, Vernon, Calif. **G. F. Pitzer,** formerly superintendent at the Lebec station, has taken over Henderson's former duties; while **W. R. Kirkland** succeeds Pitzer at Lebec.

Hunter C. Goheen, formerly geologist with Antilles Petroleum Co. at Trinidad, B.W.I., has joined Houston Oil Co. as geologist.

Willard Gill, assistant to the president of American Republics Corp. on exploration matters, Houston, has been promoted to vice president.

Henry C. Judd, treasurer of Standard Oil Co. of California, has been elected to the 1952 board of directors of the San Franccisco Chamber of Commerce.

DEATHS

Lon S. Gregory, 48, president of L. S. Gregory Co., a consulting engineering firm, died December 16 in Tulsa. He was formerly with Phillips Petroleum Co., Bartlesville, Okla., as a research engineer, and later became associated with Black, Sivalls & Bryson, Tulsa, as engineer in charge of design, gasoline plants, and refineries. He also became president of Portable Gasoline Plants, Inc., before establishing his own firm of consulting engineers.

Toddy M. Pettigrew, 64, research associate in geophysics at the National Scientific Laboratories in Washington, died there December 13. Before the war he discovered and developed a number of fields in Germany. With Dr. Robert Sarbacher, director of the National Laboratories, he had been working on an electronics device for oil exploration.

Joseph A. Jones, 51, superintendent at Owensboro, Ind., for E. Constantin, Jr., died December 8. He had been in the oil business for 25 years.

Samuel Schuyler Streeter, 25, petroleum engineer with Union Oil Co. of California, died December 15 aboard the liner Ryndam as he was returning from a vacation in Europe.

Henry J. Schafer, 83, prominent Oklahoma oil man, died December 17 at Oklahoma City.

A. B. Everett, 65, veteran gasoline refinery worker, died December 8 in Tulsa. Everett was a long-time worker for the old Cosden Oil Co., and its successor, Mid-Continent Petroleum Corp.

Sanford S. Barnes, independent drilling contractor, died December 5 at Long Beach, Calif.

Sven J. Nordstrom, 70, Lafayette, Calif., inventor and manufacturer of parts and valves used in the mining and oil industries, died December 11 at Tulsa.

Oscar E. Huie, 63, accountant for Gulf Oil Corp., died in Houston on December 1. He had been with the firm for the past 32 years.

John C. Wallace, 78, an early promoter of Rockdale-Minerva shallow oil field, died December 12 at Rockdale, Tex.

Todd P. Williams, 57, division production superintendent in West Texas and New Mexico for Texas Gulf Producing Co., died December 10 at Odessa, Tex.

Segur E. Stillman, 62, long-time employe of Carter Oil Co., died December 12 in Tulsa. He had been with the firm for 33 years.

Harold B. Hamilton, drilling contractor and geologist at Wichita, was killed in an automobile accident on December 8.

John O. Goes, 48, district superintendent in Kansas for Midstates Oil Corp., was killed in an automobile accident near Ellis, Kans., December 17.

International Oil

SUPPLY-DEMAND — World petroleum consumption outside Russian-controlled areas up 9 per cent in 1951. No serious shortages in civilian and military supplies despite shutdown in Iran latter half of year.

EXPLORATION — Notable new discoveries in Saudi Arabia, Venezuela, United States, East Indies, and Colombia, coupled with intensive development of existing pools, increased world's proven reserves to 102 billion barrels. Over half of reserve total now in Middle East fields.

PRODUCTION — World crude-oil output in 1951 totaled an estimated 11,701,500 bbl. daily, a gain of 1,264,300 bbl. or 12 per cent. Three areas accounted for 86 per cent of this gain—United States, 59 per cent; Venezuela, 16 per cent; and Middle East, 11 per cent. Important gains in Saudi Arabia, Kuwait, and Canada. Outstanding developments noted in drilling and production techniques peculiar to foreign operations, with many applications of modern recovery and field-processing methods.

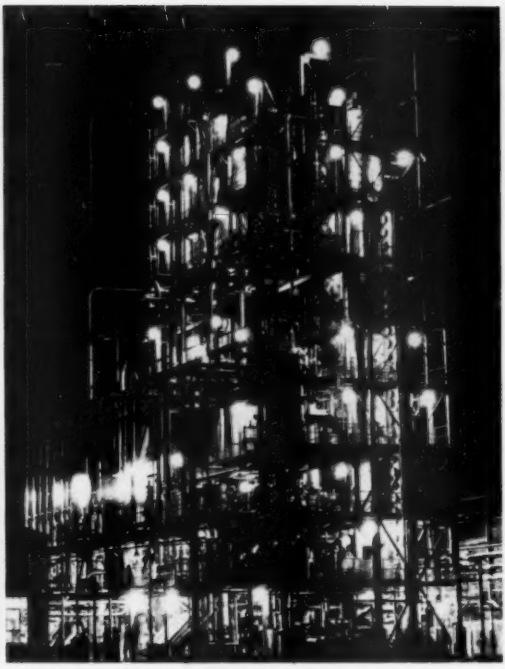
TANKERS — Greater world dependence on remote petroleum supplies coupled with large gains in consumption brought tanker shortages despite record peacetime construction. Equivalent of 625 T-2 tankers under construction at start of 1952 in Sweden, Netherlands, Germany, United States, and Norway.

PIPE LINES — The year saw the near completion of big-inch crude lines from Kirkuk, Iraq, to Barinas on eastern Mediterranean and from Lake Maracaibo to Paraguana Peninsula. Important gas lines completed in Venezuela, Mexico, Italy and Canada. Product-line construction included Italy, France, Colombia, and Venezuela.

REFINING — Shutdown of 500,000-bbl. refinery at Abadan, Iran, offset with new capacity in Western Europe and United Kingdom. Additional refinery capacity in these plants now under construction will end refinery shortage by early 1953. New refineries projected for India, Philippines, and Puerto Rico. Significant 1951 increases in refinery capacity in Canada, Venezuela, United Kingdom, France, and United States.

. . . Operating methods around the world

FROM THE JUNGLES OF SUMATRA, EAST INDIES, where a geological crew of Standard-Vacuum Oil Co., composed of nationals, is seen taking a core sample near Pendopo . . .



TO OIL-MINDED ENGLAND, where residents of surrounding areas are traveling miles to see this night scene of Shell's Stanlow refinery, oil spreads its vast operations.

OIL'S REALM IS FAR FLUNG

This picture and map section reflects petroleum's widespread activities, extending from remote jungles to urban centers in which many races and lands are participating and all benefit

Getting ready to shoot well in El Centro field of the famed De Mares concession in Colombia. The field was discovered by Tropical Oil Co., now operated by Colombian Government.

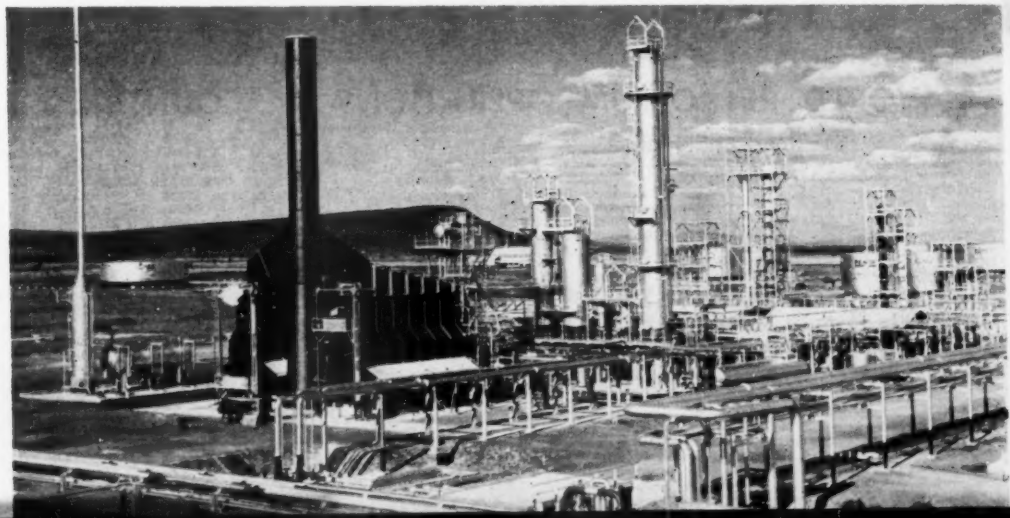
Burying one of the mammoth pipes which will transport cooling water at the Grain Island, England, site of Anglo-Iranian Oil Co., Ltd., refinery, its third in Great Britain.

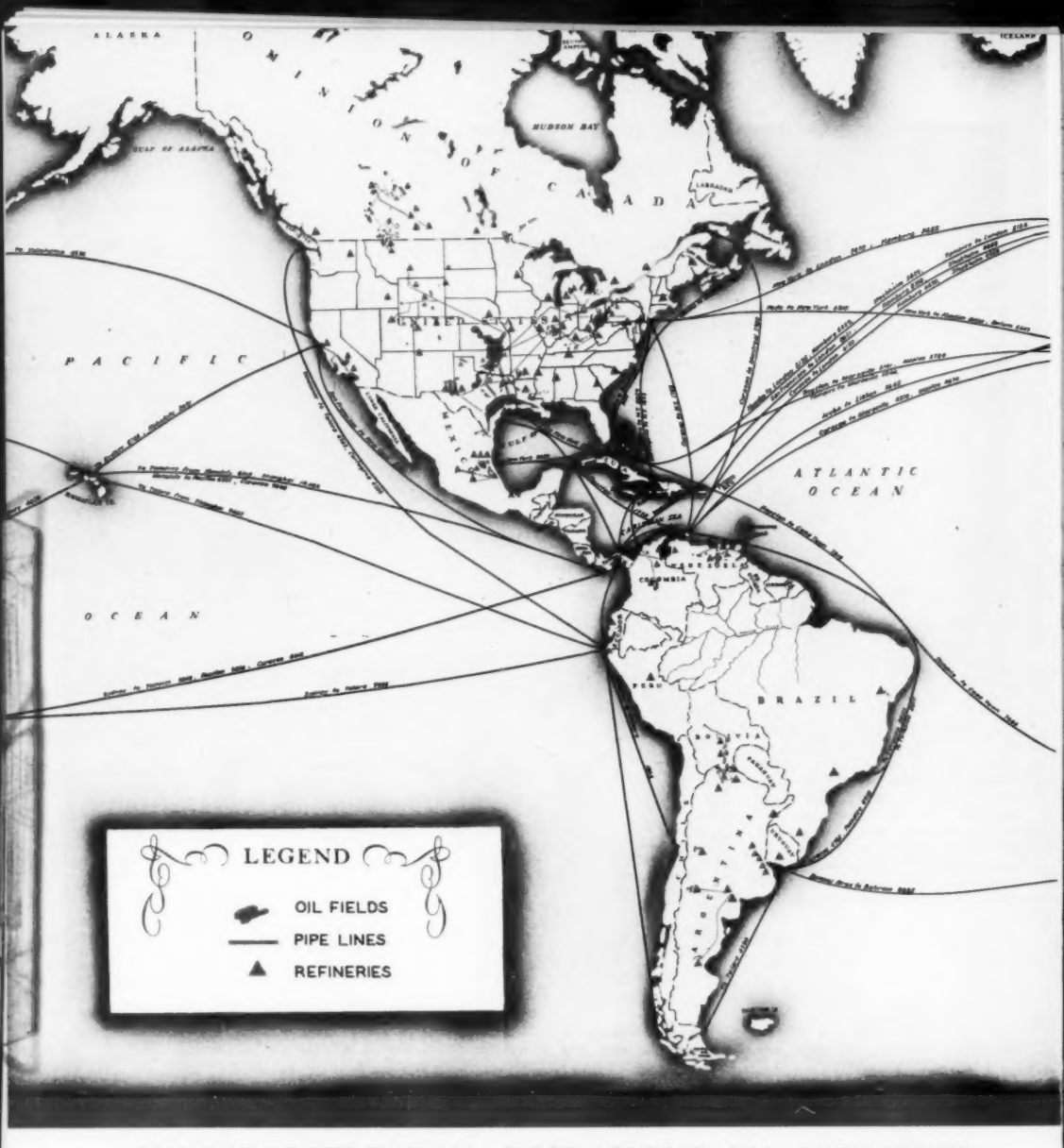
This company-trained Burmese crew is carrying on drilling operations in the Chauk, Burma, field for Burmah Oil Co., Ltd.

Portion of Iraq Petroleum Co.'s 30-32-in. Kirkuk-Banias crude-oil line, to be completed soon.

This autumn Lago Oil & Transport Co., Ltd., graduated 81 Arubian young men who had completed a 4-year course in academic subjects and practical training in well-equipped shops covering electrical, pipe, machine, and sheet-metal work, and general mechanics and carpentry. The boys shown here are working in the electrical shop at the Aruba, Dutch West Indies, refinery of the company.

Here is a view of the new refinery of Petroleos Mexicanos at Salamanca, Mexico. The plant was completed last year and incorporates latest design in facilities. View includes updraft equiflux Dubbs heaters and the Girbotol treating unit.





WORLD PETROLEUM OPERATIONS BY COUNTRIES

WESTERN HEMISPHERE

NORTH AMERICA

Country—	Proven reserves, thou. of bbl.	Estimated average prod. 1951, bbl. daily	Refinery crude-oil capacity, bbl. daily
Canada	1,600,000	134,000	424,400
Mexico	1,400,000	210,000	178,350
U. S. (Jan. 1, 1951, crude oil only)	26,121,000	6,143,000	7,026,490
Total North America	29,121,000	6,487,000	7,629,240

SOUTH AMERICA—CARIBBEAN

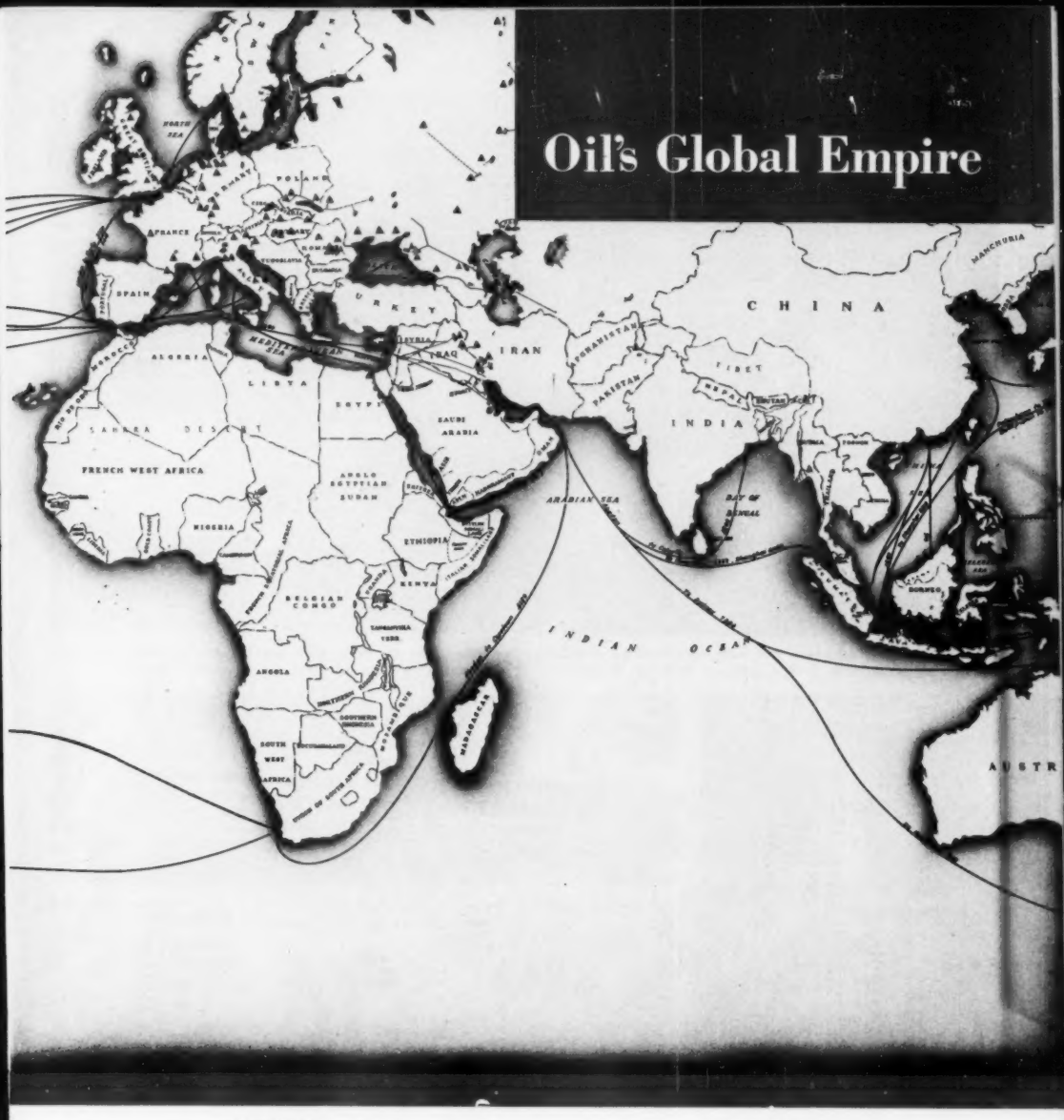
Argentina	340,000	69,000	171,050
Bolivia	22,000	1,600	10,500
Brazil	25,000	2,100	10,800
Chile	35,000	2,400	
Colombia	450,000	106,500	37,000
Cuba	3,850	300	7,800
Ecuador	25,000	7,200	4,700
Peru	170,000	44,300	38,000
Trinidad	240,000	58,900	*760,000
Venezuela	10,000,000	1,700,000	321,020
Uruguay			35,200
Total S.A.—Caribbean	11,312,850	1,990,300	1,386,070

EASTERN HEMISPHERE

AFRICA

Egypt	170,000	44,500	47,000
Fr. Morocco	5,000	1,600	1,500
Total Africa	175,000	46,100	48,500

Oil's Global Empire



FAR EAST

Country—	Proven reserves, thou. of bbl.	Estimated average prod. 1951, bbl. daily	Refinery crude-oil capacity, bbl. daily
Burma	140,000	2,000	2,000
China	15,000	2,200	1,000
Formosa			18,850
India	13,500	5,000	5,750
Indonesia—British Borneo	1,750,000	254,000	206,500
Japan	20,000	6,500	85,600
New Guinea	29,000	4,800	
Pakistan	22,000	3,300	4,800
Total Far East	1,989,500	277,800	322,500

MIDDLE EAST

Bahrein	300,000	30,100	155,000
Iran	13,000,000	†350,000	†502,500
Iraq	10,000,000	175,000	9,500
Israel			85,500
Kuwait	15,000,000	545,000	25,000
Lebanon			10,000
Qatar	1,000,000	49,500	
Saudi Arabia	12,000,000	760,000	160,000
Turkey	20,000	300	1,400
Total Middle East	51,320,000	1,909,900	948,900

EUROPE

Country—	Proven reserves, thou. of bbl.	Estimated average prod. 1951, bbl. daily	Refinery crude-oil capacity, bbl. daily
France	25,000	5,700	404,600
Germany	275,000	26,500	114,350
Italy	2,500	400	170,600
Netherlands	46,000	13,900	128,500
United Kingdom	3,000	900	502,500
Other European			138,620
Total Europe	351,500	47,400	1,459,170

OTHERS

Australia			21,100
Austria	150,000	41,000	‡25,000
Romania	300,000	85,000	‡200,000
Russia, other Eastern Europe	7,610,000	817,000	‡785,000
Total Eastern Europe	8,062,000	943,000	1,031,100
World total	102,320,850	11,701,500	12,825,480

*Includes Aruba 455,000 bbl. daily and Curacao 200,000 bbl. daily. †Operations suspended latter part of 1951. ‡Includes Sakhalin, Albania, Czechoslovakia, Hungary, Poland and Yugoslavia.

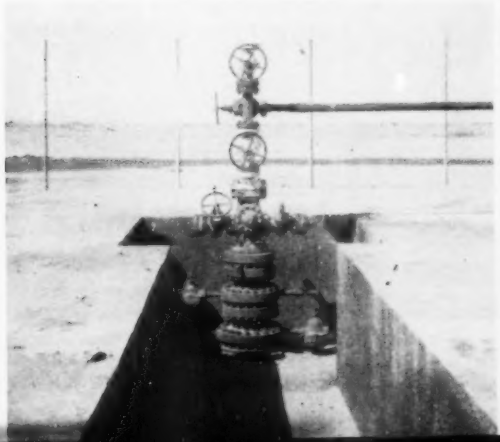
This plant produced synthetic petroleum from coal for the Germans during World War II. It is now operated with Kuwait and German crude oil by a Shell subsidiary. The plant is located in Germany between Cologne and Bonn, near the Rhine.

View of a fractionating unit at new plant of Shell Chemical Manufacturing Co., at Stanlow, England.

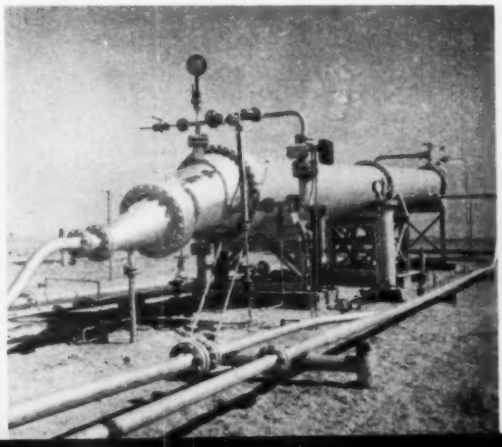
This modern hospital at Maracaibo, Venezuela, was built by Creole Petroleum Corp. and is operated under lease by the Catholic Medical Missionaries.

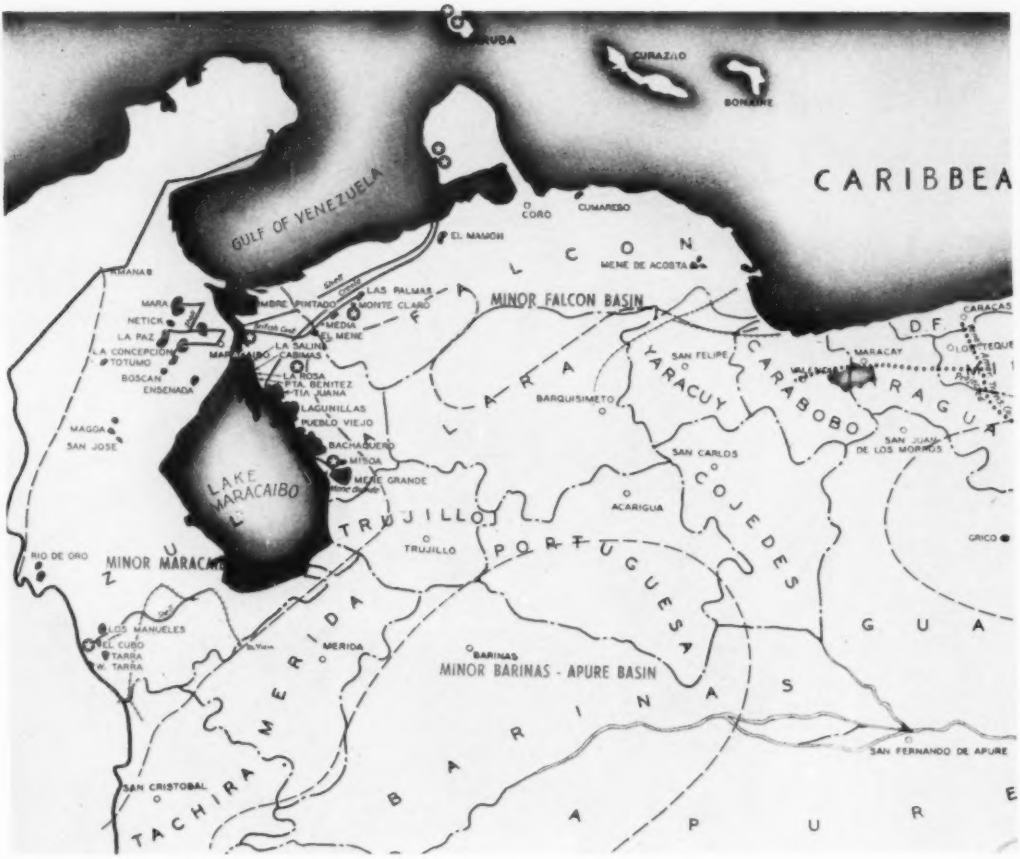
Liquefied petroleum gases are finding favor as industrial and domestic fuel at many European points. This is the loading plant at the Rotterdam, Netherlands, refinery of N. V. De Bataafsche Petroleum Maatschappij.

Well head of a flowing well in the new Zubair field of Southern Iraq, owned by Basrah Petroleum Co., Ltd.



First-stage separator in Dukham, Qatar, field, Persian Gulf area. Concession is operated by Petroleum Development, Ltd.





Tia Juana field of Lake Maracaibo, Venezuela, one of the world's largest oil reserves.

Men and machines at the new central shops of Lago Oil & Transport Co., Ltd., keep equipment in working order at the company's 425,000-bbl. refinery, located at Aruba, Dutch West Indies.

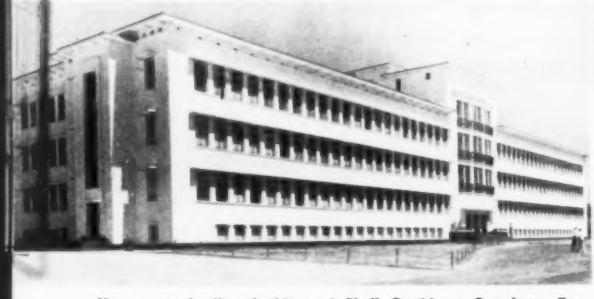
Creole Petroleum Corp. uses this unusual method to move a 129-ft. derrick from one location to another in Lake Maracaibo.

Saudi Arab roughnecks of Arabian American Oil Co. learning the technique of drilling in Saudi Arabia's Abqaiq field.

Crude-stabilization and natural-gasoline plant of Petroleos Mexicanos in Poza Rica, Mexico, field.

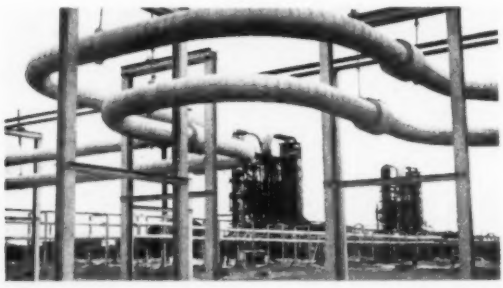
Use of airplanes for cargo and passenger transportation is expanding rapidly. This Socony-Vacuum plane operates in Venezuela.

This technician is examining core samples at the La Salina, Venezuela, laboratory of Creole Petroleum Corp.



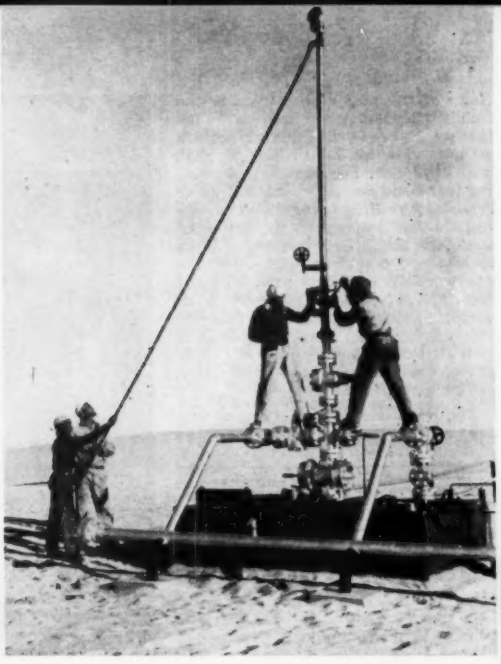
New general office building of Shell Caribbean Petroleum Co., at the Cardon refinery, in Venezuela.

German-manufactured drilling equipment in operation in the German area of the Netherlands' Schoonebeek field.



Crude-distillation units at Port Jerome, France, refinery, recently enlarged by Standard Francaise des Petroles.

On the move. Drilling rig of Arabian American Oil Co. being transported to new site. Chassis employs 9½-ft. wheels.



Arab crew cleaning christmas tree with special apparatus that removes caked grease and dirt from valve sections.

Drilling and Producing Techniques . . .

. . . that yield nearly 850,000 bbl. per day in Saudi Arabia's fabulous Abqaiq field

by Philip C. McConnell*

Data of Interest on Abqaiq . . .

FIRST OIL DISCOVERED: November 1940.
FIRST COMMERCIAL PRODUCTION: January 1946.
PRODUCTION FROM: Oolitic and dolomitic limestones of Jurassic age.
THICKNESS OF D MEMBER (MAIN PRODUCTION): 210 ft.
APPROXIMATE FIELD DIMENSIONS: 32 miles long by 6 miles wide.
MAXIMUM HEIGHT OF OIL COLUMN: Over 1,500 ft.
NUMBER OF WELLS DRILLED: 66.
NUMBER OF WELLS USED AS PRODUCERS: 61.
AVERAGE WELL-PRODUCTIVITY INDEX: 150 to 200 bbl. per day per pound draw down.
INITIAL POTENTIAL PER WELL: About 17,000 bbl. per day.
CURRENT POTENTIAL PER WELL: About 10,000 bbl. per day.
CURRENT FIELD PRODUCTION: About 575,000 bbl. per day.
NATURE OF CRUDE OIL: 38° A.P.I. sour—mixed base.
GAS-OIL RATIO: 930 cu. ft. per bbl.
ALL GAS-OIL SEPARATION IN FOUR STAGES PERFORMED AT THREE STATIONS.
FLOW-LINE LENGTHS AVERAGE 2.6 MILES, WITH MAXIMUM OF 6 MILES.
TOTAL LENGTH OF FLOW LINES: 164 miles.

DURING the past 8 years, Arabian American Oil Co., better known as Aramco, has grown up in a hurry. In 1943 the company drew oil from the desert kingdom of Saudi Arabia at an average daily rate of about 13,000 bbl. In 1950, the figure had risen to 547,000. In September of 1951 (the latest month for which figures are available at this writing), the average daily output was slightly over 847,000 bbl. The reader familiar with the problems of oil development may wonder how this rate of expansion was accomplished. The answer lies primarily in Abqaiq field, which still supplies the major portion of Aramco's production.

Abqaiq's oil accumulation is one of the world's largest. Approximately 32 miles long, averaging over 6 miles in width, it contains 61 producing wells which at this time, 5½ years after the field started to produce, still average about 10,000 bbl. per day per well. Abqaiq's present daily production of crude oil is somewhat less than 600,000 bbl.

Drilling History

The story of Abqaiq is a chapter in modern American pioneering.

*Manager of production, Arabian American Oil Co.

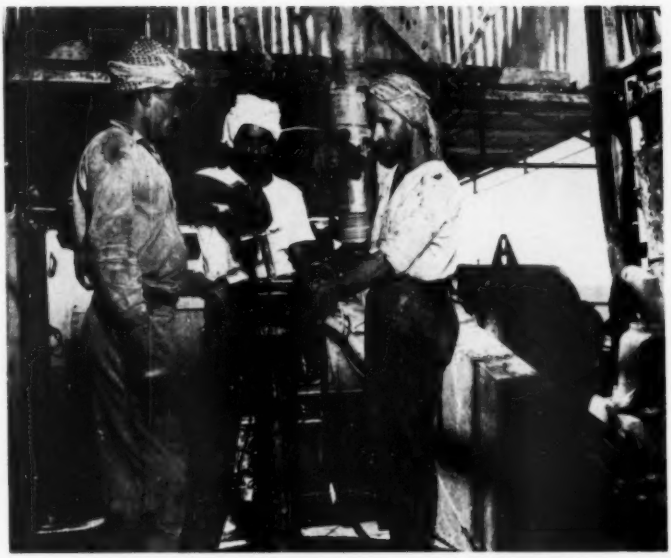
None of the major objectives in the field's development was attained easily, or even with normal effort. Abqaiq No. 1, the discovery well, was located in a broad belt of moving sand dunes after an extensive structure drilling program had indicated the presence of an anticlinal structure. There is a story about the location of that first well: how the construction foreman sent to build the wildcat camp, said to Max Steineke, the geologist responsible for the location, "Max, this certainly is it. You've found the God awfulest, God forsakenest spot on the face of the earth."

The nearest source of supplies was the Aramco camp at Dhahran, 40 miles to the northeast across rolling dune country possessing no roads—country that could be traversed successfully only by camels or the special sand tire developed by the company for this service. There was no water, no communications, no power, no fuel—just unlimited air and loose sand.

A hole dug to about 300 ft. located a skimpy supply of water. The discovery well was spudded in August 1940, a time of year when the desert temperature in the shade of a derrick rises to 130°, and the light bounces off the loose white sand with blinding intensity. Drifting sand constantly threatened to bury machinery, buildings, any equipment left in the open for a few windy days. In November of last year, the first showings of oil were encountered below 5,900 ft. In February 1941, with the threat of German invasion around the corner, the well was suspended with a blank liner cemented into the producing section.

Those were the war years when the small core of remaining Aramco employes lived off the country and such supplies as had been left over from a seven-string drilling program of earlier years. Remaining spares, plus parts robbed from other rigs, permitted a drilling string to work intermittently in Abqaiq. From 1941 through 1945, the drilling group managed to complete five Abqaiq wells and suspend a sixth because of a bad fishing job—not much of a performance under normal conditions, but in those days of scarcity, a commendable achievement. Trucks were not available for a part of 1943; and the drilling of well No. 3 was made possible by cement, barytes, bentonite, and diesel oil hauled on the backs of camels, 200 to 500 lb. to a camel load. At the time, Aramco was carrying about 750 camels on the payroll.

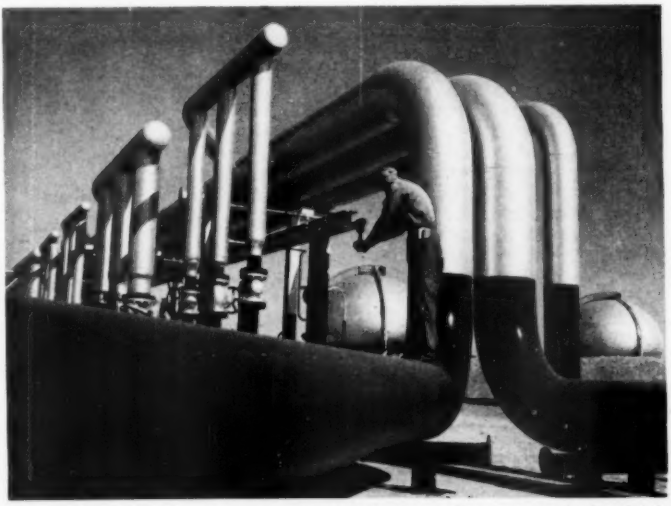
By 1946, the material situation was easing, and Aramco was able to obtain delivery on several new diesel-operated rigs. By the middle of 1947, six such rigs were operating in Abqaiq, five of which were devoted to development operations. This marked the peak of drilling activity, for operations were reduced to two rigs on development in 1948, and to one in 1950. Drilling was stopped at the end of that year with the completion of 66 wells. Of this number, 61 are available as producers, and 5 serve as observation points on the flanks and near the crest of the structure. No further drilling is contemplated until the production performance of the reservoir indicates the justification for such action.



Saudi Arabian roughnecks at work on Aramco rig north of Abqaiq.

Structure

The contour map (Fig. 1) shows that the Abqaiq structure consists of a long and relatively narrow anticline, having its major axis oriented east of north and west of south. The most unusual structural feature is the relation of the northern and southern areas. The southern area contains an anticline of unusually large closure; the northern area, approximately three-fourths as long as the southern, forms a broad, relatively low extension of this anticline. The vertical distance from the top of the oil accumulation in the main anticline to the oil-water contact is approximately 1,500 ft., whereas the



Vertical triplets of pipe in gas-oil separator installation to relieve pressure load and help provide gas-free oil.

oil column in the northern area seldom exceeds 240 ft.

Pattern of Well Locations

These structural differences have had a marked effect on the pattern of wells drilled to develop the field. The discovery well was located near the top of the main anticline; and early development was devoted to the problem of outlining this feature. The first 10 wells established a line down the major axis and a transverse line near the minor axis.

As the basic shape and extent of the main structure became evident, plans were adopted for developing the field by drilling wells on a given contour, or "ring," around the anticline, rather than on the block pattern usually forced on the American operator because of property requirements. In the absence of contending ownerships, Aramco could develop with the objective of a minimum number of wells located where the prospects were best for maximum life.

As any operator knows, if he has tried to develop a field according to the ring pattern, the chief problem is to determine on which contour to drill. In the early stages of development, few fields provide sufficient data to permit reliable calculations of the speed of edgewater rise or of gas-cap descent on the flanks of the structure. Lacking this information, the operator is forced to make some high-powered guestimates in attempting to determine at which contour the well will have the longest life before it is taken by water from below and gas from above. Aramco engineers found themselves faced with just this problem.

The company decided to drill two rings of wells on the main anticline. Those on the upper ring, aimed for the —6,000-ft. contour, possessed the advantage of being able to draw from the main producing member for at least several years before capture by gas would occur. Thereafter, they could be plugged back to produce from a shallower member which extended only a short distance beyond this ring. (To date, such action has been unnecessary.) A second ring was placed near the —6,500-ft. contour because of the great width of productive area (averaging about 2 miles) between the —6,000-ft. ring and the oil-water contact at approximately —7,120 ft. Twenty wells were placed on the —6,000-ft. ring, concentrated near the ends of the oval contour, but with a nominal spacing of about 4,500 ft. Eighteen wells near the —6,500-ft. ring were spaced approximately 8,500 ft. apart. A few additional wells have been added near the ends of the main structure.

Ring development of the flat northern area has appeared impracticable. As the contour map shows, wells in this portion of the field have been confined to exploration holes plus a few drilled in the vicinity of the axis. This has resulted in a spacing approaching the block area. The development pattern has not been completed in this area. Drilling will be resumed when production performance and/or pressure relationships indicate that additional wells will be needed to effect efficient drainage. The high permeability of the producing formations may permit satisfactory drainage by the present wells, which usually are at least a mile apart and have an opportunity to draw oil from formations up to 3 miles distant.

Drilling Practices

Drilling of the total area of the field by the number of producing

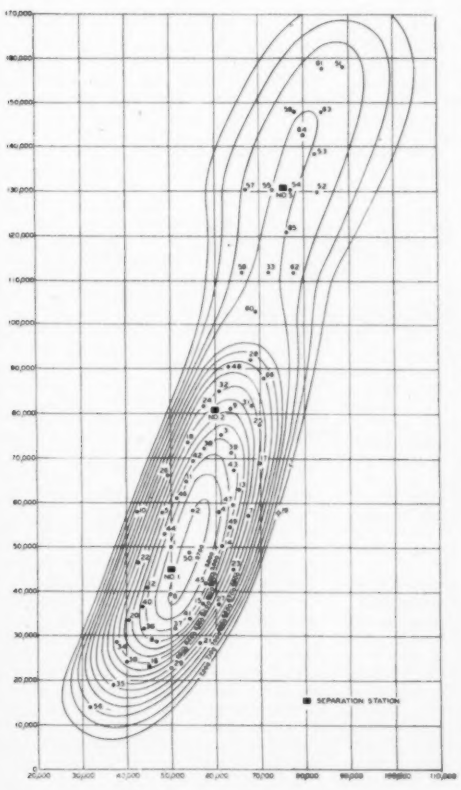
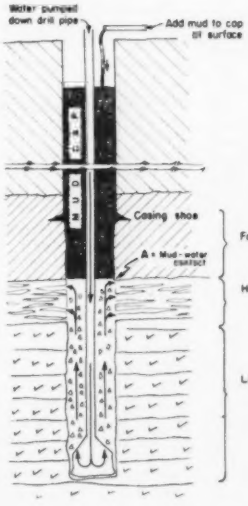
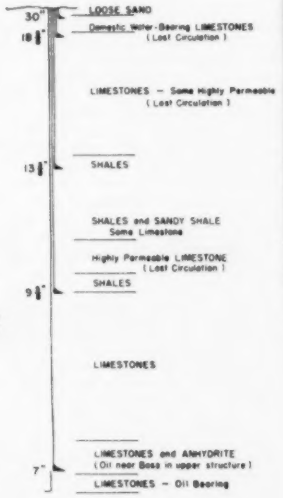


Fig. 1 — (Left) Structure contour map of Abqaiq field.

Fig. 2—(Below) Conditions while drilling with a mud cap.

Fig. 3—(Right) Maximum casing program for Abqaiq field.


Water pumped down drill pipe
Add mud to cap at surface
Casing shoe
A = Mud-water contact
Formations above lost circulation zone
(Walls sealed by mud filter Cake)
Highly Permeable Formations where circulation is lost
(Contains Water or Oil and Gas under pressure which would cause flow at surface. Water and bit cuttings received by these rocks.)
Less Permeable Formations
(Will not receive bit cuttings, but contains Water, or Oil and Gas under pressure which would cause flow at surface.)



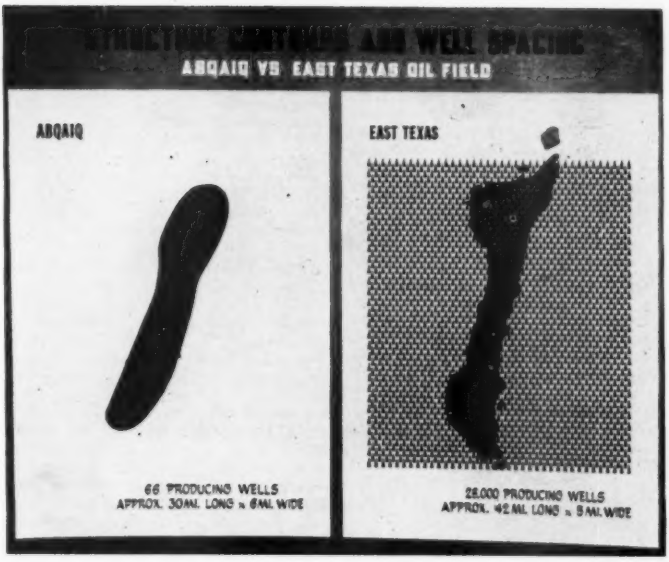
wells shows that the average area per well is over 1,400 acres.

Abqaiq drilling technique possesses certain interesting features which, in the main, are shared with other Saudi Arabian fields. Many of the limestones penetrated by the drilling bit are so highly permeable that they present a constant hazard to the rotary driller. The drilling mud either shows a discouraging habit of disappearing into the rocks, or tends to foul the walls of the hole with a heavy filter cake which sticks the drill pipe. Add the further complication that the formation pressure gradient is not uniform and therefore, that waters of large volume and high pressure will rush from one horizon to another if not controlled, and you begin to understand why Abqaiq wells may require five strings of casing in order to obtain the final water shutoff above the producing formation. In the absence of surface sand, domestic water, and lost circulation, a few wells have been completed with two casing strings. Common practice has required three when the conductor and domestic water string can be eliminated.

Aramco's drilling methods have improved markedly during the years of Abqaiq's development. Wells completed in this field during 1946 required an average drilling time of nearly 4 months. By 1948, 40 to 45-day completions were the rule. In the elapsed period, drilling weights had been increased and rotation speeds had been decreased; but far more important was the development of knowledge and procedures concerning the use of drilling fluids. Aramco drillers have made hole for many years without circulation, pumping up to 20,000 bbl. per day of water down the drill pipe to cool the bit and carry the cuttings into the highly permeable rocks. They use the same method, with one important addition, in drilling through high-pressure water-bearing zones and through the oil-producing member itself, when circulation is lost. Oil, water, or gas under high pressure is controlled by placing a mud cap in the annulus outside the drill pipe. This amounts to floating a column of mud on top of the stream of water rising from the drilling bit and flowing out into the permeable limestones. It's a fairly delicate technique, not recommended for the novice, but one that every Aramco driller must learn to employ.

The technique of drilling with a mud cap may justify a brief explanation. Fig. 2 is presented as a diagram of subsurface conditions while hole is being drilled in this manner.

Arrows mark the path of water pumped down the drill pipe, through the bit, then up the annulus, carrying the formation cuttings into the rocks of high permeability. The mud column, or cap, weighing 80 to 90 lb. per cu. ft., floats on the rising water column, and thus maintains the exact downward pressure necessary to equal the total upward pressure developed by formation fluids and rising water streams at point A, the highest level of water escape into the permeable rocks.


ABQAIQ VS EAST TEXAS OIL FIELD
ABQAIQ
66 PRODUCING WELLS
APPROX. 30 MI. LONG × 6 MI. WIDE
EAST TEXAS
28,000 PRODUCING WELLS
APPROX. 42 MI. LONG × 9 MI. WIDE

As the 80 to 90-lb. mud is floating on water possessing much less weight and viscosity, a small but constant dilution of the mud takes place at the bottom of the cap. This loss is balanced by the continual addition at the surface of similar amounts of new mud poured into the annulus between drill pipe and casing.

The diagram indicates that the top of the mud cap does not extend to the surface. In practice, it stops several hundred feet below ground level. If insufficient mud is added and the column becomes too light, it starts to rise and will eventually flow out of the hole. The several hundred feet from overflow at the surface to the top of the mud cap is the driller's safety factor. If too much or too heavy mud is added, it simply pushes an excessive amount off the bottom of the cap into the permeable rocks, along with the water stream. If the mud in the cap is of suitable quality, the well will show no tendency to flow while drill pipe is being pulled or run.

As in normal drilling operations which use water as the circulating liquid, hole is dug much faster with water and a mud cap than with circulated mud.

A well drilled in Abqaiq today probably would start on a sand dune as much as 75 ft. in depth. A layer of decomposed limestone, or marl, about a foot thick, would be spread over the loose sand. This and a concrete-lined cellar, 8 ft. square and about 5 ft. deep, would be the only permanent preparation. Wooden mats consisting of two crossed layers of 3 by 12-in. planks would be laid on the marl. On the mats would be set the three major units of the drilling rig: the derrick, the draw works-engine unit, and the pump unit—all portable and all hauled across the dunes to the location, on sand tires. Lesser units, such as mud tanks, mud-mixing platform, and power plant, would be arranged on the marl and sand.

Fig. 3 shows the current casing program. The surface string, or conductor, would be set through the sand dune deep enough into the underlying lime to keep the dune out of the hole. (This is an important precaution, for when the surface string has not been set low enough, the driller has, on occasion, looked down through the rotary table to discover nothing below him but an alarmingly large hole spreading rapidly toward the derrick corners.) The next 2,500 ft. would be drilled with a thin gel slip or with water, and most of it without circulation. In the northern area, 18⅝-in. casing would be cemented at about 450 ft. for the purpose of protecting shallow domestic water. A string of 13⅜-in. casing would be set at 2,500 ft. in order to exclude the first general interval of lost circulation. The next 1,000 ft. would require top-quality mud having either a lime-caustic-starch or a phosphate treated clay base. Circulation probably would be lost for the second time at the base of this interval, and the following 500 ft. would be drilled with water and a floating mud cap. After 9⅝-in. casing had been set to exclude this

(Continued on page 326)

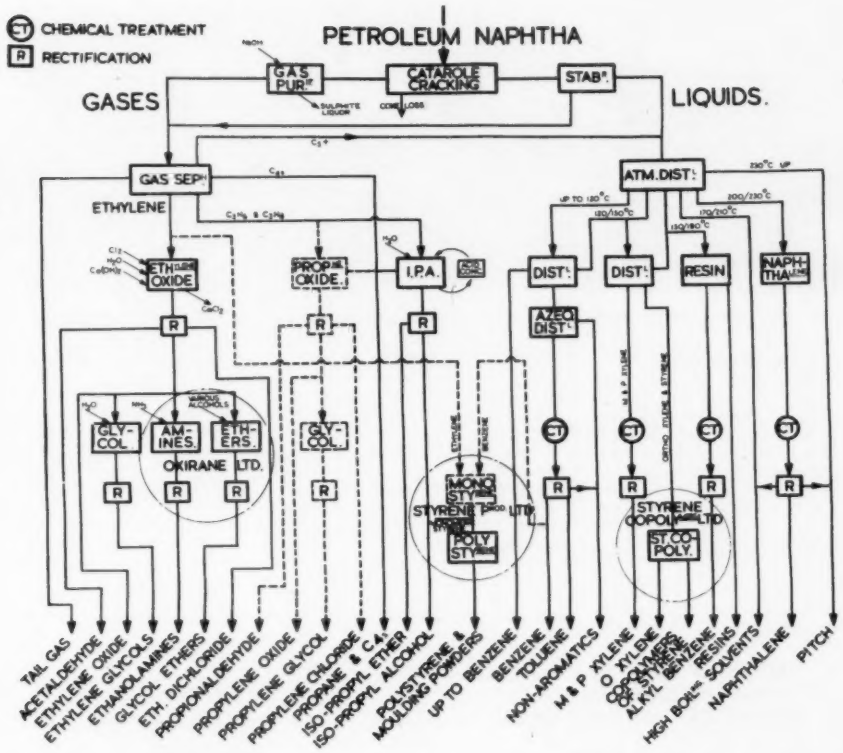


Fig. 1—Diagrammatic flow chart showing manufacture of petrochemicals at the Manchester plant of Petrochemicals, Ltd.

New Petrochemicals Plant Producing Full Range Of Products From Middle East Naphtha

by H. E. Charlton*

The history of this project, starting with the development from a new idea and culminating in the construction on a previously undeveloped site, is an absorbing story.

ONE of the most important chemicals - from - petroleum plants' in Great Britain is that of Petrochemicals, Ltd., situated by the Manchester Ship Canal about 7 miles from Manchester and occupying 120 acres of an 885-acre estate. The project has been in partial operation for some time and all plants are now in production making a wide variety of pure chemicals, narrow-boiling-range solvents, resins, and other polymers including polystyrene.

This project consists of an integrated group of plants for the separation, purification, and conversion of the products arising from the Catarole cracking process.

The Catarole vapor-phase cracking process effects the transformation of petroleum naphtha into gases with a large proportion of olefins and a highly aromatic liquid ("crackylate"), and is unique in principle, design, and operational results. The five furnaces installed on this plant were designed to crack 75,000 tons a year. However, experience in actual operation has proved that these units can deal with at least 110,000 tons a year (approximately 2,500 bbl. U. S. daily).

Products

The accompanying flow chart (Fig. 1) shows with solid lines those plants which are in actual operation, and with broken lines those which are proposed to be built as a future development.

At the bottom of the flow chart is a list of the various chemicals currently produced from this plant. Typical yields from Middle East petroleum

*Director and engineer-in-chief, Petrocarbon, Ltd.

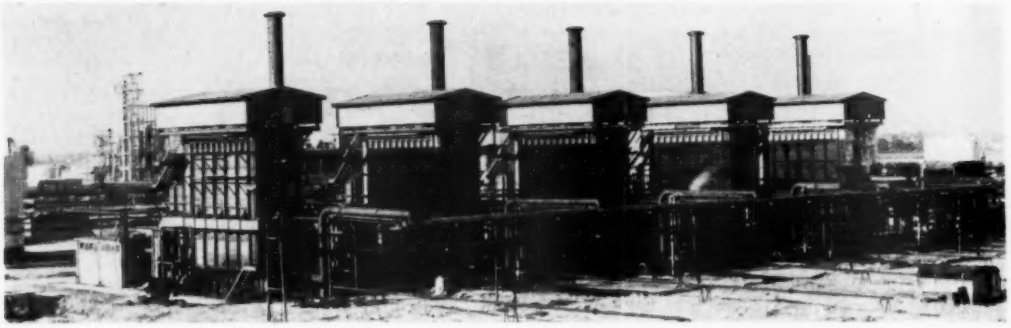


Fig. 2—Five Catarole cracking units which produce liquid and gas products from petroleum naphtha.

naphtha (boiling range 120° to 240° C.—248° to 464° F.) are:

	Weight per cent on feed stock
Hydrogen	0.4
Methane	17.3
Ethylene	13.3
Ethane	9.2
Propylene	10.5
Propane	1.3
Butylenes, butadiene, butanes	3.0
Gases	55
Pre-benzene	1.6
Benzene	5.8
Nonaromatics in benzene boiling range	0.4
Toluene	5.6
Nonaromatics in toluene boiling range	0.3
m- and p-Xylene	2.9
o-Xylene and styrene	2.3
Alkyl benzene	6.0
Prenaphthalene	1.2
Refined naphthalene	0.6
Alkyl naphthalene	4.0
Liquids	30.7
Anthracene cut	3.4
Pyrene/chrysene cut	3.4
Hard pitch M.P. 150°-170° C., 302°-338° F.	4.5
Pitch 60°-80° C. M.P.	11.3

From a study of the large number of products it is obvious that many separation and synthesis plants are required to exploit them fully. This cracking process differs most from others in the quality of the liquid product, as, due to its high aromaticity (93-95 per cent on the crude benzene cut) it is possible to separate the individual pure components relatively easily.

Those active gum-forming bodies, which are a great nuisance in heavily cracked but incompletely aromatized gasolines made by other cracking

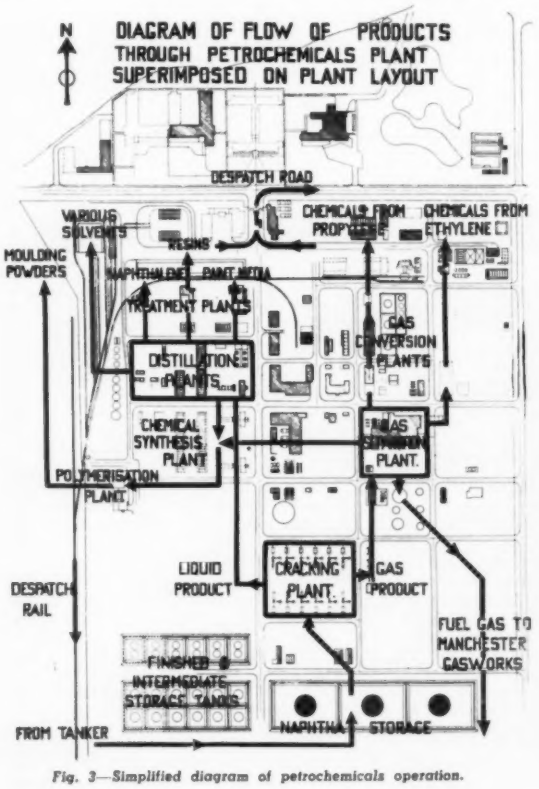


Fig. 3—Simplified diagram of petrochemicals operation.

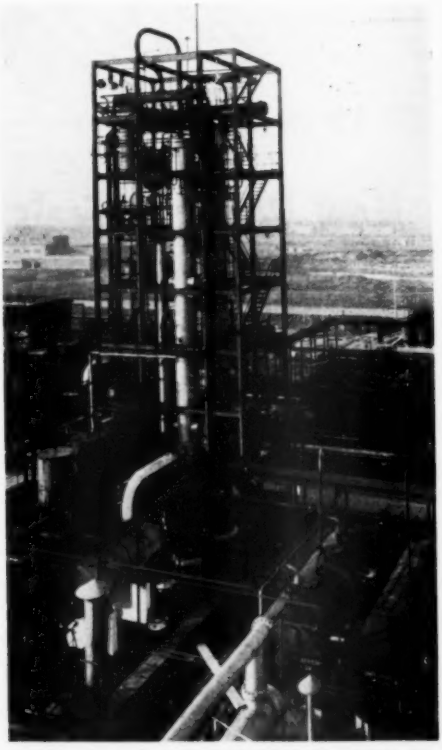


Fig. 4—Distillation unit of the ethylene oxide plant.

Fig. 5—View shows: right foreground, light-oil-products unit; background, left to right, isopropyl alcohol and gas-separation plants.

processes, yield from the liquid product or crackylate of the Catarole process valuable resins and other polymers.[2]

Although so far the highest solid aromatic to be isolated and purified in the plant is naphthalene, processes are known for the separation of higher solid aromatics, such as anthracene, phenanthrene, pyrene, and chrysene, and these products have been recovered on a pilot-plant scale.

Vapor-Phase Cracking

Fig. 2 shows the five Catarole furnaces which are in operation in this plant. The naphtha is fed to these plants from a ring main maintained under pressure, is filtered and goes through flow meters to the vaporizers situated in the convection part of the furnace where heat is obtained from the flue gases. The completely vaporized naphtha is piped to the cracking tubes which are situated in the radiant heated section of the furnace, and heated by five gas and oil burners disposed at the top of the furnace.

Reactors.—After cracking, the products pass to reactors in order to complete the aromatization in a zone maintained at a uniform temperature. The control of temperature in this lower part of the furnace is achieved by flue-gas recirculation. At the outlet of the aromatization zone the products are quench cooled with water. The oxidation of the carbon formed in the process is carried out at regular intervals at the normal working temperature of the furnace in such a way that there is no interference with the steady flow of production.

Onstream period of 8 months between routine inspection and maintenance are normal, but could be extended. After nearly 3 years' service, the alloy-steel tubes would appear from inspection to have many more years of life with careful operation. The criteria of furnace operation control are simple, being only gas density and specific gravity of the up to 200° C. (392° F.) cut of the liquid fraction.

Condensation.—The condensing and cooling equipment is somewhat unconventional, as only 40 to 45 per cent of the products are condensable. The separation of water from the products is a difficult problem to which consideration has been given since some of the fractions of the crackylate are heavier than water, whereas others have a density less than that of water.

Gas-Separation Plant

As can be seen from the diagrammatic flow chart superimposed on the plant layout, Fig. 3, there are two chains of plants starting from the crackers, one dealing with the gases, the other the liquids. Considering the gas chain, the first link is a caustic scrubber for the removal of H_2S, the content of which is reduced to less than 0.1 p.p.m., or well below the gas referee's official test for H_2S content which requires less than 1.5 p.p.m.

Low-temperature processing.—After purification, the gas is compressed to about 10 atm., cooled, dried, and then liquefied by refrigeration to about —120° C. (—184° F.). At this temperature only the hydrogen and part of the methane remains in the gas phase, together with a very small amount of ethylene. The liquid phase is then fractionated in a series of columns, first removing methane, then ethylene and ethane, followed by propane and propylene, and finally the mixed C_4's.

The ethylene-ethane stream from the second column is then separated into the pure components in another column working at just above atmospheric pressure, at a mean temperature of about —90° C. (—130° F.). All the low-temperature parts of this plant are contained in hermetically sealed and thermally insulated cold boxes.

These operations are carried out in the gas-separation plant, which is by far the most costly and important secondary plant, and it was especially designed, engineered, and constructed for the separation of gases from the Catarole process, by Petrocarbon, Ltd. Because of high fuel costs in Great Britain, this plant was designed for the minimum utilities consumption. It is completely under automatic control, and Fig. 6 shows part of the control room where these instruments are centralized.

The tail gas is supplied to the Partington Gas Works of the North Western Gas Board for coal-gas enrichment, via a 6-in. pipe line which connects the two works. Any excess over the quantity which can be taken by the gas works is used as refinery fuel. During one period the quantity of gas supplied in this way represented, in heating value, about 15 per cent

(Continued on page 328)

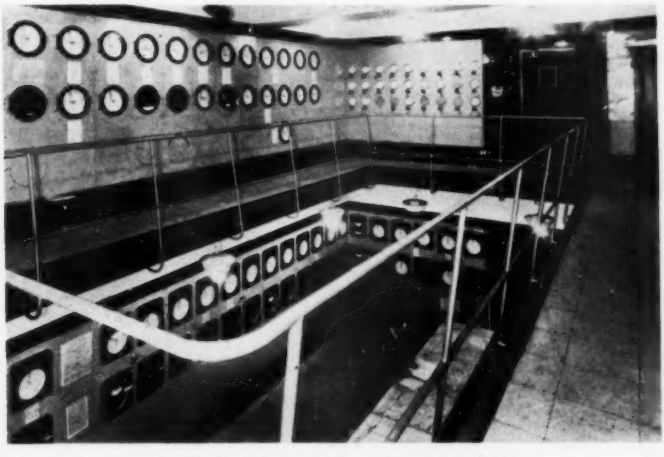
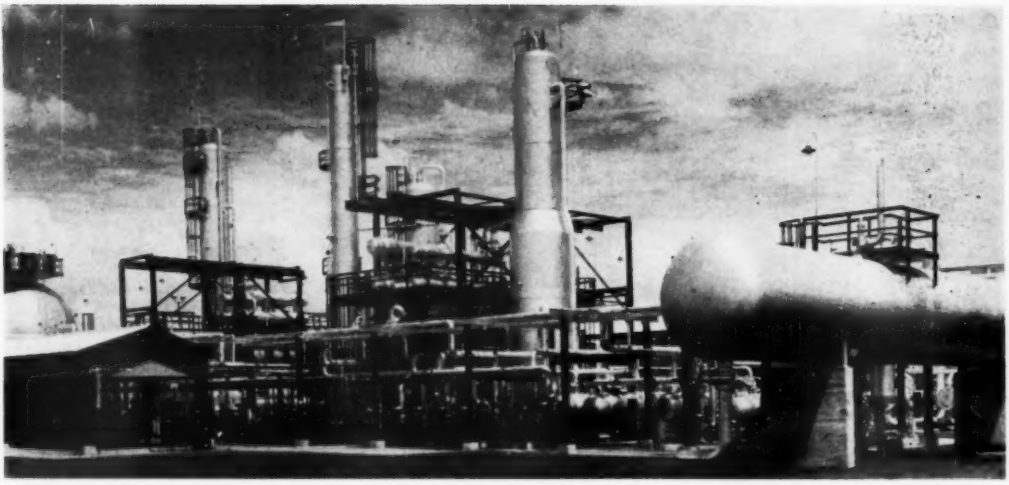


Fig. 6—Control room of the gas-separation plant.



Mulata plant of Creole Petroleum Corp. Left foreground, control house; left background, dehydration sphere; center, lean-oil still, gasoline stabilizer, low-pressure absorber, and crude stripping towers; right foreground, crude surge drum.

Creole Operates Two Multifunction Plants

Venezuelan nationals have been trained to fill all key posts in both plants, replacing United States personnel

by
W. F. Ganskopp*
and
H. J. Roeder*

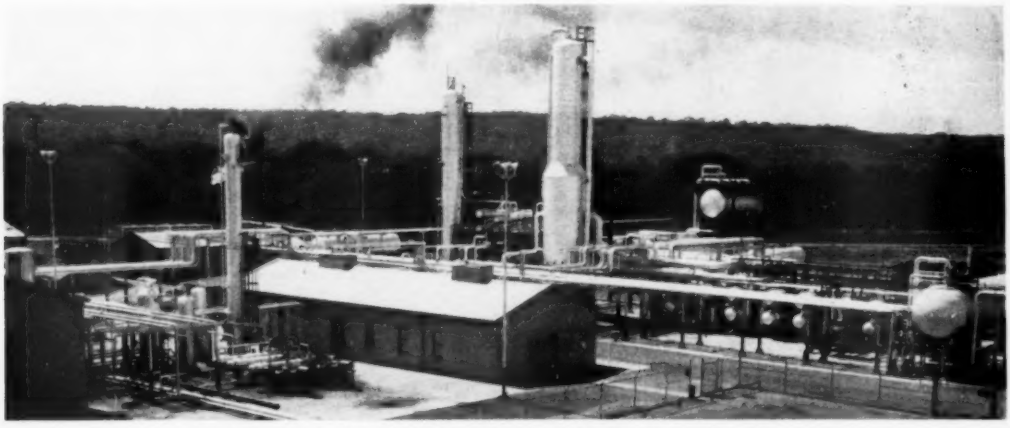
CREOLE PETROLEUM CORP. operates two combination plants for processing crude and gas produced in Jusepin and Mulata fields which are situated in the State of Monagas, eastern Venezuela. These plants, which are approximately 10 miles apart, process all the crude and most of the gas produced in their respective fields and they each perform four major functions, namely: (1) crude dehydration; (2) gas absorption; (3) crude and gasoline stabilization; and (4) compression of gas for pressure maintenance. In addition to these, a fifth function is in the process of being added, namely that of compression of gas for gas-lift operations.

*Creole Petroleum Corp.

The Jusepin plant, which is owned by Creole, was placed on stream in September 1947; the Mulata plant, which is owned jointly by Pantepec Oil Co., Mene Grande Oil Co., and Creole, began operations during January 1949.

Design of Plant

Jusepin. — The Jusepin plant was built to handle 40,000 bbl. per day of crude and 10,000,000 standard cubic feet per day of wet gas from field separators. Plant facilities included a



General view of Creole plant located in Jusepin field of eastern Venezuela.

THE AUTHORS

W. F. GANSKOPP

H. J. ROEDER

crude-stripping tower, an 800-b.hp. compressor for processing crude-stripper vapors, a gasoline stabilizer, mechanical dehydration equipment, two 800-b.hp., 4-cycle, gas-engine-driven compressors, operating in two stages, for compression of gas from 250 to 2,200 psi. for pressure maintenance and a 10,000,000 standard cubic feet per day absorber which uses stripped crude as absorption medium.

A revamp of the Jusepin plant has just been completed wherein pressure-maintenance capacity has been increased from 10,000,000 to 25,000,000 standard cubic feet per day. The plant now has 5,040 hp. of compressors in pressure-maintenance service including two new 1,320-b.hp. units, the two 800-b.hp.'s which were originally in pressure-maintenance service, plus the 800-hp. unit which was initially in process service, having been replaced by a new 300-hp. unit. All new pressure-maintenance compressors are three-stage operation to compress gas from 50 to 1,800 psi. The remaining units, also, will soon be converted to three-stage operation due to declining production of high-pressure gas.

In addition to the revamp which has just been completed, additional work is now in progress to install two additional 1,320-hp. compressors for supply of some 15,000,000 standard cubic feet per day of 650-psi. gas for gas-lift operations in Jusepin field; also, a new absorber is to be installed which, together with the existing unit, will provide a total of about 40,000,000 standard cubic feet per day of absorption capacity.

Mulata.—The Mulata plant was designed for handling 20,000 bbl. per day of crude and 60,700,000 standard cubic feet per day of high and low-pressure wet gas from field separators. Plant facilities included a crude-stripping tower; an electrical dehydration sphere; a 500-psi. absorber having a capacity of 20,000,000 standard cubic feet per day; a 150-psi. absorber with a capacity of 40,000,000 standard cubic feet per day; a 70-psi. reabsorber; a lean-oil still and lean-oil reclaimer; a gasoline stabilizer; one 800-b.hp. gas-engine-driven compressor operating, single-stage, in process service; and seven 800-b.hp. gas-engine-driven compressors, operating in three stages, for compression of some 20,000,000 standard cubic feet per day of gas from 25 to 2,200 psi. for pressure maintenance.

Plans are now being made for installation of three new 1,100-b.hp. compressors for compression of 18,000,000 standard cubic feet per day of low-pressure gas for gas-lift operations.

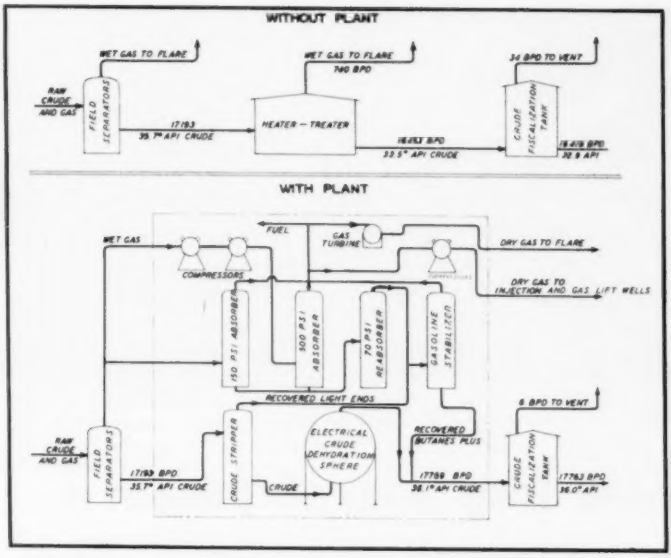
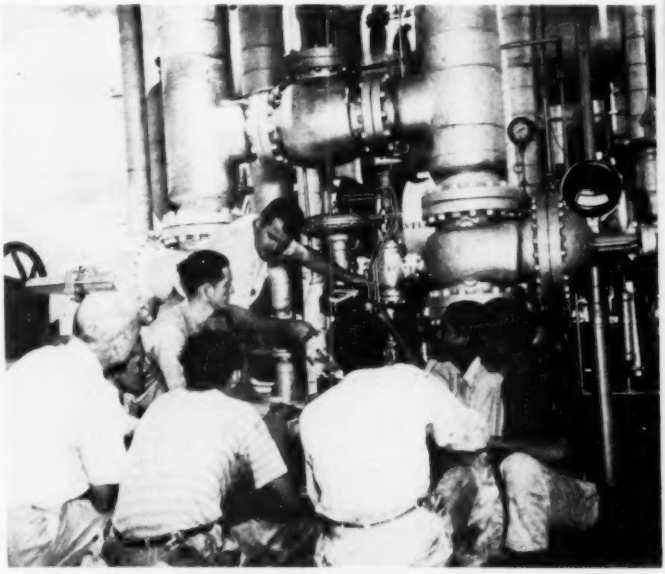


Diagram showing operation with and without crude stabilization and gas absorption in Mulata field.

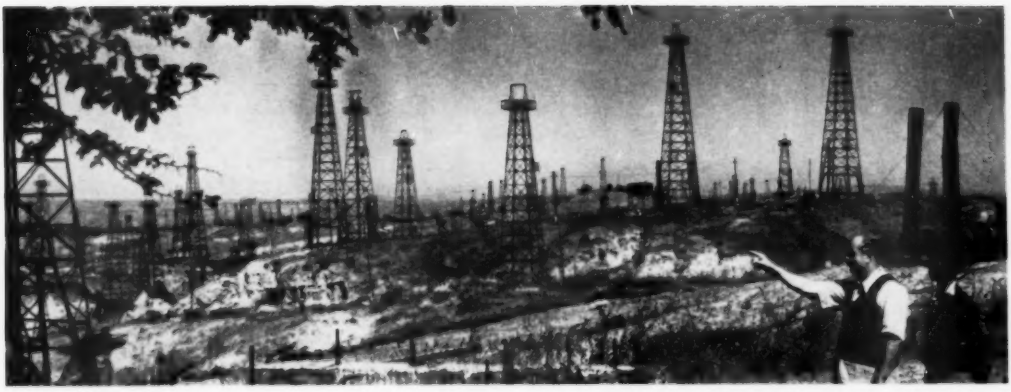
Process Flow

Jusepin. — Raw crude from field separators is pressured to the plant where it enters a crude surge drum maintained at 100-psi. back pressure. A small quantity of vapors is flashed off the raw crude in the surge drum. These vapors join the wet gas stream

(Continued on page 329)



Venezuelan and other employes receiving on-the-ground instruction in operation of instruments.



View of portion of Chauk field in central Burma, where a limited amount of new drilling is now in progress. Field is on left bank of the Irrawaddy, and extends across the river bed to Lanwa on the right bank.

After Long Delay, Expansion in Burma Finally Under Way

New drilling started, and refining facilities are being enlarged. New "joint venture" proposal eyed.

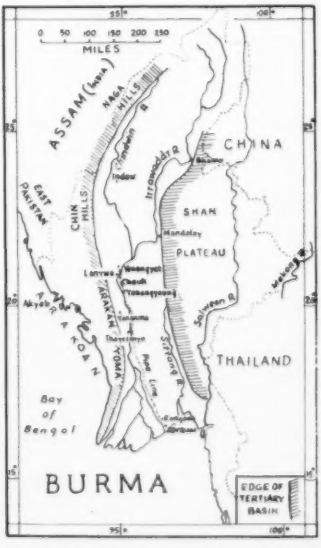
LAST month saw the start of a limited amount of new drilling by Burmah Oil Co. (Burma Concessions), Ltd., at Chauk, in the Central Burma oil fields.

Coinciding with these operations is the expansion of refining facilities in Chauk field where the erection of a two-stage distillation unit is progressing steadily.

In terms of the world oil situation, however, or even of the oil-supply position in the East, the operations now planned and in progress are not likely to have any effect; only a few new wells will be drilled (and these in the proven fields); with the pipe line still inaccessible there is no foreseeable hope of oil exports, and producing and refining are concentrated in the one area of the oil fields where the presence of Burmese troops makes it reasonably safe to work.

In the unsettled state of affairs that has persisted in Burma since the outbreak of civil strife in 1948, Burmah Oil has been producing and refining as much oil as can be moved to local markets. Most goes by river (up and down the Irrawaddy from Chauk) in bulk oil flats, always accompanied by armed escorts in case of insurgent attack. In good months—

Burmah Oil is extending its refining facilities to Chauk, in central Burma oil fields, by erecting a Koch unit, the towers and stack of which are shown here in position.



Oil development in Burma centers along the Irrawaddy River, on which production is moved in bulk oil flats.

Four Cardwell units were among the equipment used by Burmah Oil Co. to recondition junked wells after the war. This one is drilling out a prospective plug placed in well to prevent unauthorized access to the oil.

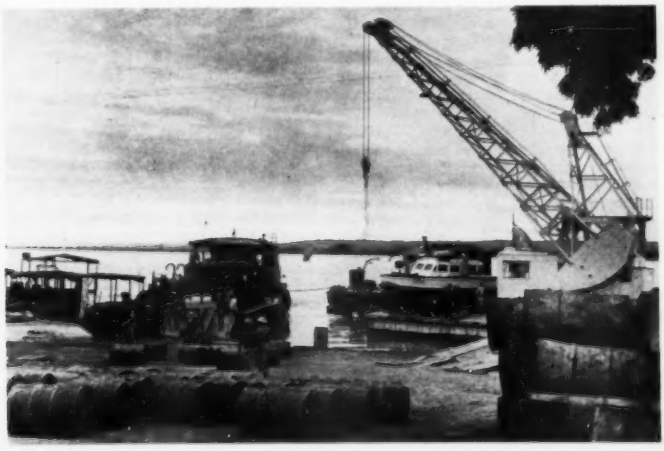
that is, when craft and escorts are available and the river is high—roughly 40 per cent of the country's requirements of motor fuel, kerosines, diesel oils, and fuel oil is met from indigenous production. Imports supply motor fuel for Rangoon and coastal towns, and all aviation fuel lubricants.

The oil industry, as much as any other industry in Burma, suffers seriously from the lack of secure communications in the country. Rail services, where these are running, are frequently interrupted by insurgent activities, roads between towns are unsafe except in a few areas, and the oil fields are kept in touch with Burmah Oil's head office in Rangoon mainly by the company's aircraft.

Even so, the introduction of new drilling, although it will employ only a single string, and the expansion of refining facilities reflect an improvement in Burma's internal conditions over recent years. Production at Chauk is currently running around 2,400 bbl. daily—four times the 1949 volume—so new production has to be found and refining capacity increased in readiness for the day when more outlets for products become accessible.

It is against this background that the Burmese people view the proposal for operating the indigenous oil industry by a joint enterprise between the Burmese Government and the British-owned oil interests in Burma—Burmah Oil and the Indo-Burma and British Burmah petroleum companies. The "joint venture," as it has became known, is a scheme whereby a local company would be formed with shares held jointly by the government and the oil companies. It has been under discussion for some time—the first proposal was submitted to the Burmese Government by the oil companies in 1948—but financial difficulties then delayed completion of the arrangements. The parties are agreed in principle (the Burmese suggesting that, after Iran, all-out nationalization is perhaps not the best pay) and recently the British Government offered the Burmese Government a loan of £2,500,000 to help it finance its share in the proposed new company. Though this amount would not be enough to enable the Burmese to take a one-third share, the agreed initial proportion, the oil companies have offered a plan whereby they could enter into one-third participation in the joint venture immediately. There the matter rests, at present, though further discussions may have taken place since this article was prepared.

Joint operation of the producing and refining operations, however, would still be a long way from the full-scale restoration of the Burma oil industry.



Scene at Chauk during the loading of a petroleum cargo for Prome, halfway between the central Burma oil fields and Rangoon.

Prewar Production

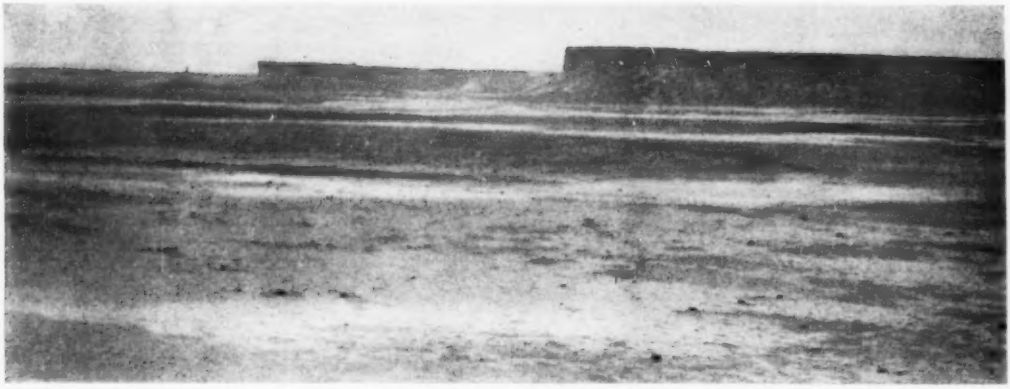
Prior to the outbreak of war, production from the Burma fields was at the rate of a million tons a year. Transported by pipe line and river the crude was refined at Syriam, near Rangoon, into a wide range of products to meet all Burma's requirements and about half of India's. Wax from Burma went to the United States, South America, South Africa, Europe, and many other parts of the world.

Early in 1942, upon the approach of the Japanese invaders, the Syriam refineries were demolished by order of the Allied high command to deny their use to the enemy. Wells in the Chauk, Yenangyuang, and other smaller fields on the Irrawaddy River between Rangoon and Mandalay were junked to make them unusable and the 327-mile-long pipe line from the oil fields to Syriam was put out of action. These thoroughgoing denial measures were later reinforced by Allied bombing during the course of the war.

By the time the war in the East ended, Burmah Oil had ready extensive plans for rehabilitation, including the construction of a new refinery at Syriam. The program, put into effect when military control over the company's properties ceased early in 1946, made good progress. By 1947 production was resumed from newly reconditioned wells in the oil fields and the pipe line was partly repaired.

At Syriam, plans for the new coastal refinery were complete, though the procurement of steel and finished components met with some delay. A topping plant, erected at Chauk primarily for local needs, was temporarily expanded to fill in the gap, and this is the refinery that has been

(Continued on page 330)



Tuwaiq Mountain escarpment formed by differential weathering of weak Jurassic shales below and resistant limestones above. Interior of Arabia about 40 km. southwest of Riyadh. (Photo by Max Steineke).

Exploration Gets Results in Saudi Arabia

by D. B. Ficher* and M. P. Yackel*

Further rapid expansion has focused attention on the Middle East even more sharply this year. Saudi Arabia continued developing into one of the world's most important oil producing countries. During 1951 production was started from the great Ain Dar field, two new fields were discovered, and the country's production increased from about 618,000 bbl. per day at the beginning of the year to about 850,000 during September. This growth was the result of an orderly and intensive long-range exploration program begun several years ago, stimulated only slightly by the nationalization of the industry in Iran.

THE western part of the Arabian Peninsula is a portion of the stable Arabian - African basement shield, while the eastern part is a sedimentary foreland-shelf area sloping off northeast into the Mesopotamian (or Persian Gulf) geosyncline. The shelf is covered by marine and continental sediments ranging in age from Paleozoic to Recent—the result of advances and recessions of the seas from the geosyncline onto the shelf. In general the older formations advanced farther onto the shelf than did the younger, so that the present surface picture is roughly one of concentric bands of sedimentaries out from the basement area, each basinward band being younger than the previous one. Bordering the basement are the Paleozoics, principally sandstones and shales, but with some limestone. Cambrian, Ordovician, Silurian, Devonian, and Permian are represented and can be differentiated by fossils in many places.

In contrast to the rugged basement topography, the Paleozoic area is lower and more rolling but in places is deeply incised by erosion. In the middle of the peninsula are remarkable exposures of Jurassic in the area of the Tuwaiq Mountains. These are composed mainly of limestones and shales, some of which are extremely rich in well-preserved fossils. The highest Jurassic formation is anhydrite. To the east are plateaus of Cretaceous sandstones, shales, and limestones, in turn overlain along the present coast of the Persian Gulf by Paleocene, Eocene, and younger Tertiaries.

Near the basement the sediments are, of course, relatively thin, but they rapidly increase in thickness basinward until along the present gulf they may reach 20,000 ft. or more. Tectonic activity in the area of the sediments has not been intense, but rather has been a series of intermittent epeirogenic movements resulting in gentle, elongated structures oriented more or less parallel to the strike of the beds.

The Aramco concession covers in excess of 400,000 square miles in the eastern, sediment-covered portion of the peninsula. It is under the coastal belt of the Tertiaries bordering the Persian Gulf that all of the Arabian oil fields have been found. One field, Safaniya, was brought in this year from an off-shore location, 3 km. out in the gulf. Only one Arabian field, Dammam (the first discovery in the country), has a clear surface expression— an Eocene window surrounded by Miocene. Qatif field is considerably more obscure, but does have some surface indication. All other fields have required an intensive program of geophysical exploration or structure drilling before their discovery. Principal production is from the Upper Jurassic "Arab zone," with its four oolitic and dolomitic limestone members interbedded with anhydrite. Middle and Lower Cretaceous sands and pre-Arab zone Jurassic limestones have been successfully tested, but are not currently producing. The fields are shown on the accompanying map and are more fully discussed later.

Exploration Activities

During the past few years Aramco's exploration activity has been intense and diversified. Currently the exploration department has in the field the following operations: three surface-mapping parties, two triangulation parties, two gravity meter-magnetometer parties, two seismograph parties, and three structure drill parties using six rigs. Along with this field work are concomitant office and laboratory operations such as paleontology, photogrammetry, cartography, research, and warehouse supply. Two-way radio

*Arabian American Oil Co.

BELOW are the basic characteristics of the Nalco No. 33 method, one of several Nalco approaches to problems of cooling water treatment. At right are typical results —such as YOU may expect with the Nalco System.

- Provides *complete* recirculating system protection against scaling and corrosion.
- Maintenance of pH between 6.0 and 6.5 prevents scaling, stops delignification of cooling tower lumber, and cuts chemical requirements for slime and algae control as much as 50%.
- Use of Nalco No. 33 builds microscopic, impervious protective film on pipelines and equipment to positively prevent corrosion.
- Non-toxic Nalco No. 33 makes use safe; eliminates contamination problems.
- Silica concentrations in recirculating water may be allowed to run much higher without danger of SiO_2 depositions.

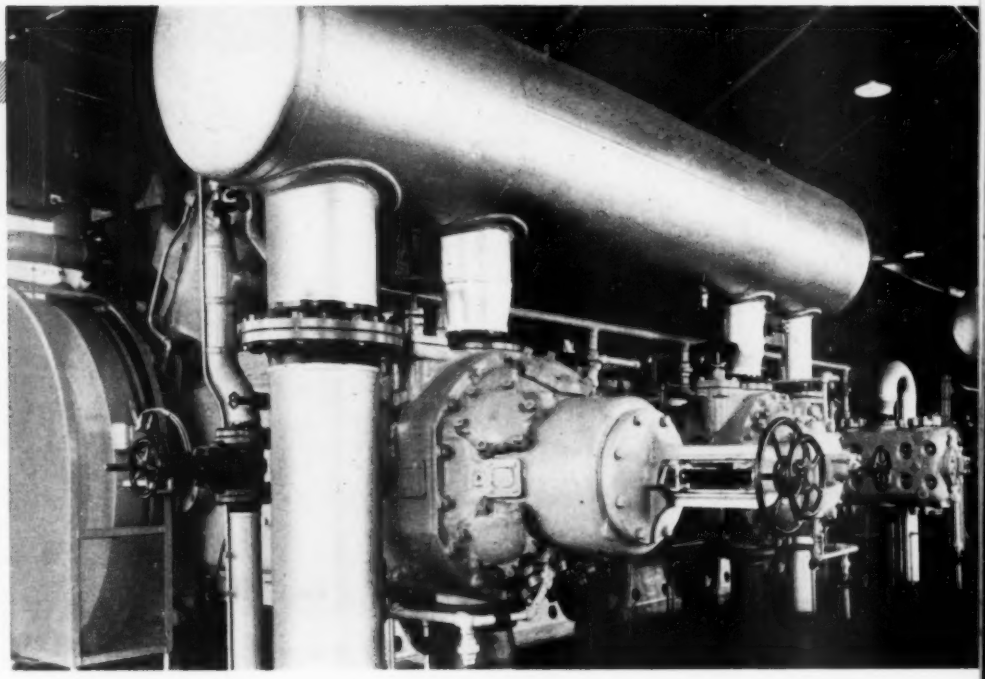
Write for complete details on Nalco System cooling water treatment fitted to your requirements.

Type of Plant	Recirculation Rate (gpm)	Hardness of System Water (ppm)	Results (as reported from the field)
Refinery	105,000	550	Gradual improvement during the 22 months of operation with No. 33 has been experienced in cleanliness of the system and absence of corrosion. Slime control has been easier.
Compressor Station	4,800	1,200	This job was almost impossible to treat. Results are excellent.
Chemical Plant	2,100	1,000	Condensers have been in service two years without cleaning. No scale or plugging of tubes due to bacteria or slime was found within that time.
Steel Mill	1,200	40	Results are excellent. High skin temperatures in furnace are experienced but no corrosion or scale has been found in these hot sections since using No. 33.
Distillery	4,300	200	Very good. They experienced considerable slime before starting treatment. The lower pH permitted slime control with economical dosages.
Gasoline Plant	2,000	3,400	Coils at the base of the tower stay clean in spite of the tremendously high hardness.

NATIONAL ALUMINATE CORPORATION
6242 West 66th Place Chicago 38, Illinois
Canadian inquiries should be addressed to Alchem Limited, Burlington, Ontario

THE *Nalco* SYSTEM • **Serving the Petroleum Industry through Practical Applied Science**

At the Lolita Compressor



MAGNOLIA PETROLEUM COMPANY was one of the first to put a Cooper-Bessemer supercharged GMV into service. And it's shown them a new and sure way to cut costs.

Installed over a year ago in the Lolita Compressor Station, this supercharged GMV and three former-type GMV's are working side by side. All are 10-cylinder units, running at the same speeds and requiring equal space. Yet the supercharged GMV is conservatively rated 1,350 hp — a full 35% gain over the other units.

Think what this offers in cutting over-all installation, piping, operating and maintenance costs! Moreover, there's greater-than-ever economy in lube and fuel consumption.

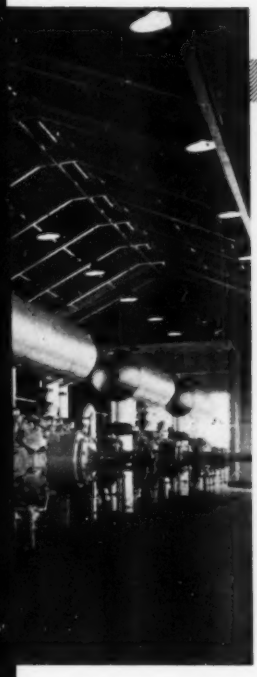
Cooper-Bessemer V-angles, modern GMX's, GMV's and GMW's, meet all compressor needs from 200 to 3,000 horsepower. They're your best bet for reliability and peak economy.

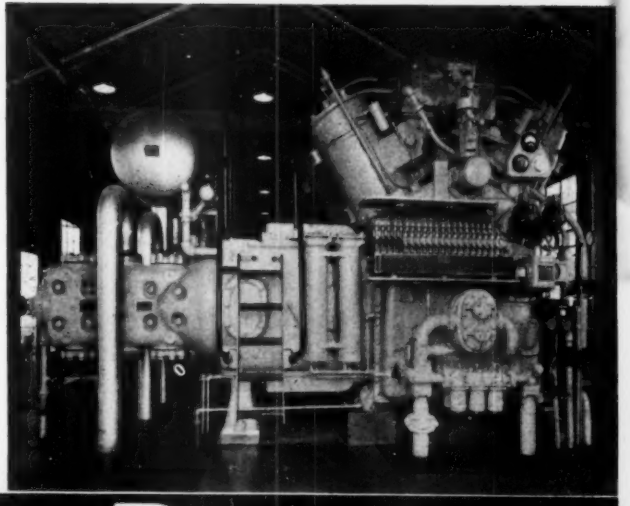
V ANGLE **Compressors**

New York Washington, D. C. Bradford, Pa. Parkersburg, W. Va.
San Francisco, Cal. Houston, Dallas, Greggton, Pampa and Odessa, Texas Seattle, Wash.

Station .... Supercharged GMV .a natural for new economy

Another Example of Efficient Power at Lower Cost





Above: All four Cooper-Bessemer GMV-10 compressors in Lolita, North LaWard, and Maurbro Field Operators' Lolita Compressor Station, operated by Magnolia Petroleum Company . . . three 1,000 hp GMV's and a 1,350 hp supercharged GMV. Here, casinghead gas is taken from field at 10 psig suction and raised to 1,000 psig discharge for delivery to high pressure absorber in Magnolia's West Ranch Plant.

Right: Close-up of operating end of supercharged, 1,350 hp GMV-10 in above Lolita Compressor Station. Unit provides 35% power increase over former-type units.

by **Cooper-Bessemer**

MOUNT VERNON, OHIO AND GROVE CITY, PENNA.

Tulsa Shreveport St. Louis Los Angeles Chicago Caracas, Venezuela

communication is maintained continuously between all field parties and the Dhahran base.

Summary of Oil Fields

Dammam field. — Structure: An Eocene window surrounded by Miocene. Upper oil zone discovered in 1935, and main producing formation discovered in 1938. Producing area is an oval-shaped dome with axes about 5 and 4 miles long.

Upper oil zone: Middle Cretaceous porous limestone, equivalent to the producing zone of Bahrein Island; small amounts of heavy oil with sweet gas, but nonproductive; depth about 2,000 ft.

Main producing formation: Upper Jurassic Arab zone, with its four oolitic and dolomitic limestone members, "A," "B," "C," and "D," each separated from the next by anhydrite. Depth to top of producing zone is about 4,500 ft. at crest of structure.

Average daily production: In September 1951, 84,972 bbl. per day.

Gravity: 35° A.P.I.

Number of wells: In September 1951, 32 producers, 2 of which are gas wells, 9 abandoned.

Tools: One string operating in September 1951 on workover jobs.

Abu Hadriya.—Structure: Circular dome determined by surface and seismic mapping and structure drilling. Discovery well drilled in 1940. Subsurface structure not yet clearly delineated.

Oil zone: Upper Jurassic porous limestone about 500 ft below the Arab zone. Depth to top of potential producing formation is about 10,100 ft.

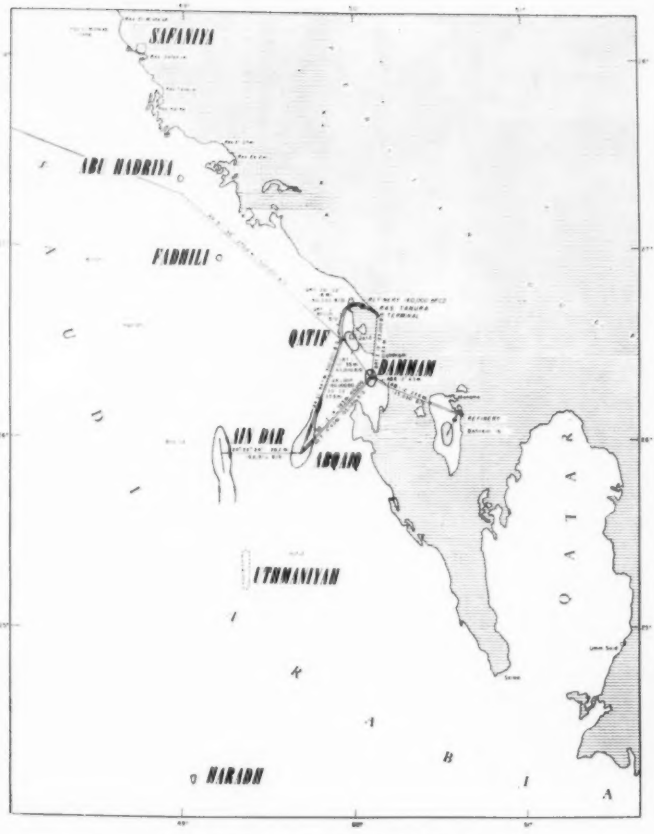
THE AUTHORS

D. B. EICHER

M. P. YACKEL

D. B. Eicher was graduated with an M.S. degree in geology from University of Chicago in 1939. He worked with Standard Oil Co. of Egypt, a subsidiary of Standard Oil Co. (N. J.), from 1939 to mid-1942; with Dominican Seaboard Oil Co. in the Dominican Republic during 1942 and 1943; and again with Standard of Egypt from 1943 to 1949. In the fall of 1949 he went to Saudi Arabia as research geologist for Aramco, and is currently stationed in the New York office of that company.

M. P. Yackel graduated from Pomona College with an A.B. degree in 1927 majoring in physical sciences and mathematics. During the depression years he took graduate work in geology and mineralogy at the same institution. Concurrently he was consulting geologist for various industrial concerns in the Los Angeles area from 1939-1942. After 3 years in the Navy, he was employed as a field geologist by Aramco in Arabia from 1946-1947. Since returning to the United States, he has been on Aramco's geological staff in San Francisco and New York.



Map of Saudi Arabian oil fields and pipe lines.

Gravity: 35° A.P.I.

Number of wells: One capable of producing but shut in; one abandoned.

Tools: No strings operating in September 1951.

Abqaiq field.—Structure: Elongated anticline determined by structure drilling; discovery well drilled in 1941; productive area 30 miles long and 8 miles wide.

Producing formation: "D" member (porous limestone) of the Upper Jurassic Arab zone. Depth to top of producing zone is about 5,800 ft. at crest of structure. Some oil is present in the "C" member (higher than the "D"), and some indications have been found in a deeper Upper Jurassic zone.

Average daily production: In September 1951, 596,342 bbl. per day.

Gravity: 39° A.P.I.

Number of wells: In September 1951, 66, of which 3 are observation wells and 62 are on current production.

Tools: No strings operating in September 1951.

Qatif field.—Structure: Elongated anticline, barely discernible on the surface; confirmed by structure drilling. Discovery well drilled in 1945; productive area about 9.5 miles long and about 2 miles wide.

Producing formation: "C" and "D" members (porous limestone) of the Upper Jurassic Arab zone. Depth to top of producing zone is about 6,900 ft. at crest of structure.

Average daily production: In September 1951, 20,687 bbl. per day.

Gravity: 30° A.P.I.

Number of wells: 12, of which 6 are producing and 4 are capable of producing; 1 observation well and 1 abandoned before reaching a productive horizon.

Tools: No strings operating in September 1951.

Ain Dar field.—Structure: Elongated anticline trending N-S, determined by structure drilling. Discovery well was completed in November 1948. Productive area proved to date is 25 miles long and 3 to 5 miles wide.

Producing formation: "D" member (porous limestone) of the Upper Jurassic Arab zone. Depth to top of producing formation is about 6,600 ft. at crest of structure. Shows of heavy oil in overlying "C" member.

Average daily production: In September 1951, 146,066 bbl. per day.

Gravity: 35° A.P.I.

Number of wells: In September 1951, 25 of which 10 wells are currently on production, 1 observation well; 14 wells shut in awaiting installation of production facilities.

Tools: Four operating in September 1951.

Fadhili.—Structure: Determined by structure drilling. Discovery well drilled in 1949. Subsurface structure not yet clearly delineated.

Oil zone: Middle Jurassic porous limestone about 1,500 ft. below the Arab zone. Depth to top of potential producing formation is about 9,800 ft.

Gravity: About 38° A.P.I.

Number of wells: One capable of producing but shut in.

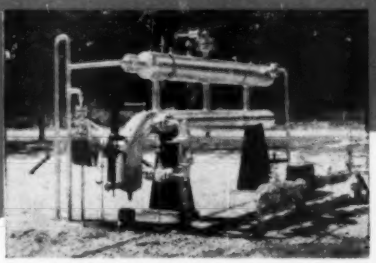
Tools: No strings operating in September 1951.

Haradh.—Structure: Irregular dome or brachyanticline determined by structure drilling and confirmed by a gravity-meter survey. Discovery well drilled in 1949.

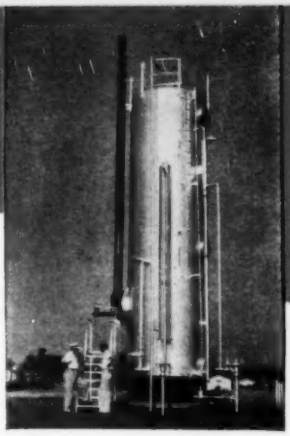
(Continued on page 293)

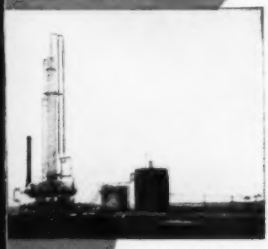
New Equipment
PIONEERED
and PROVED
by BS&B
in 1951

TYPE J EMULSION TREATERS



HIGH-PRESSURE WATER-OIL-GAS SEPARATORS





ONOMICAL GAS DE-SULPHURIZERS

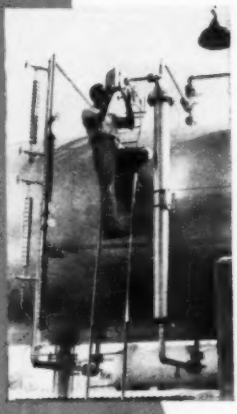
What does "PIONEERED and PROVED by BS&B" Mean to the Petroleum Industry?

For almost 60 years, the Petroleum Industry has looked to Black, Sivalls & Bryson, Inc., for the development of efficient equipment to produce more oil and gas and make the production more profitable; for reliable equipment to protect the producer against mechanical flaws and technical failures. Over the years, BS&B has earned this confidence with a consistent record of new equipment, "Pioneered and Proved by BS&B" . . . .

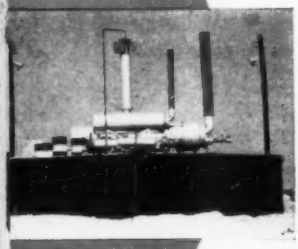
In Production . . . BS&B oil and gas equipment is increasing production, raising the quality of the products, simplifying the production cycle . . .

In Profits . . . BS&B equipment is making oil and gas production more profitable by lowering per-barrel and per cubic foot costs . . . reducing maintenance expense and increasing the recovery of condensate and other marketable petroleum by-products . . .

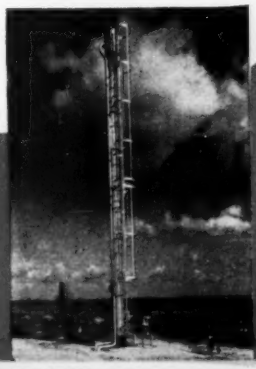
In Protection . . . BS&B goes an extra step before offering new and improved equipment to the industry — proving the equipment in the field where production records and profit potentials can be accurately analyzed by any prospective purchaser. BS&B's pioneering is not considered complete until it is proved.



CLIMAX TYPE 860 LIQUID LEVEL CONTROL



SIMPLIFIED FIELD STABILIZATION



EFFICIENCY BS&B RELIABILITY

BS&B has 35 Branches in the Oil Country — there's one near you.

BLACK, SIVALLS & BRYSON, INC.

Oil & Gas Equipment Division — Department 24J-A

2131 Westwood Boulevard, Oklahoma City, Oklahoma

FOR

- successful "first-time cementing"
- remedial cementing
- many special drilling and production techniques...

The Baker Model "K" Cement Retainer is world famous for its success in all types of squeeze jobs and re-cementing for placing cement or fluid through tubing or drill pipe at any desired point behind the casing or liner; around the shoe; or into open hole below the shoe. Adapted for use as a Casing Bridge Plug. Either tool may be set on a wire line, as well as on tubing or drill pipe.

The Baker Retainer Production Packer (Product No. 415-D) meets most production requirements with unequalled flexibility, safety and economy. ★ Can be set on tubing or drill pipe— or on a wire line by your choice of the leading electric wire line service organizations.

Baker Oil Tools are always

The Baker Model "F" Stage Cementing Collar meets the demand for stage cementing equipment that will insure the fluid-tight integrity of the casing string after the cement has been displaced. This collar operates entirely by fluid pressure, and no movement of the casing is required after completing the first stage of cementation. All internal material is readily drillable, leaving an unrestricted passageway.

Use Baker BAKWIK Drill Pipe Floats (Product No. 480) to reduce wear and tear on wire lines and rig equipment. ★ Greatly reduces possibility of wet strings due to clogged bits and drill pipe.

You will have "BETTER RESULTS WITH BAKER"

The Baker Model "RT-8" Retrievable Cementer is a safe, positive, device for testing casing, or locating holes in pipe; placing cement, plastic, acid, or any other fluid; at any necessary pressure behind the casing or liner through perforations, or in open hole below the shoe. It is operated mechanically and is not dependent upon fluid pressure to set or release.

When your casing is equipped with Baker Model "G" Casing Centralizers (Product No. 910-G) you *know* that it is **REALLY CENTERED** with better chances for a "first-time" water shut-off.

★ In directional holes "sled-runner-action" of the springs helps to get pipe to bottom.

No more torn swab rubbers or packing elements. Slips on testers or packers can always contact casing.

★ A Baker ROTO-VERT Casing Scraper (Product No. 620-C) run on drill pipe, or a *wire line*, scrapes casing free from gun-shot burrs and hardened cement.

Practical and Dependable!

BAKER OIL TOOLS, INC.

HOUSTON • LOS ANGELES • NEW YORK

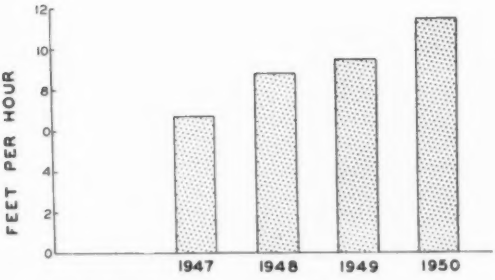


Fig. 1—How penetration rates have been increasing.

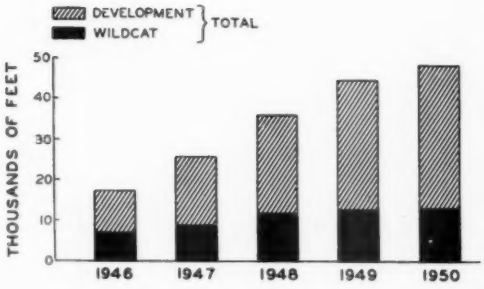


Fig. 2—Average footage drilled per rig per year.

Modern methods applied to

International Petroleum's Peruvian Operations

by W. H. Holmes,* G. S. Coleman,* E. L. Anders, Jr.,* and J. M. Marsh*

Systematic study and testing have brought increased rates of penetration, and better casing and cementing techniques have helped to improve well performance

INTERNATIONAL PETROLEUM CO.'s Peruvian operations are centered in northwestern Peru along the Pacific Coast, at a latitude of 4° south of the equator, and cover approximately 650 sq. miles of desert country.

The eastern one-third of the concession is occupied by a low range of metamorphosed Paleozoic mountains. Flanking these mountains to the west are sediments of the Quaternary, Tertiary, and Cretaceous epochs.

Profound normal tensional faulting has affected the sediments in this area, and displacements of some of the fault systems are nearly 10,000 ft. This great faulting and attendant rapid facies changes are the causes of countless special drilling and producing problems. The challenging geological conditions have led to adoption of many special practices.

*Petroleum engineering group of International Petroleum Co., Ltd., Talara, Peru.

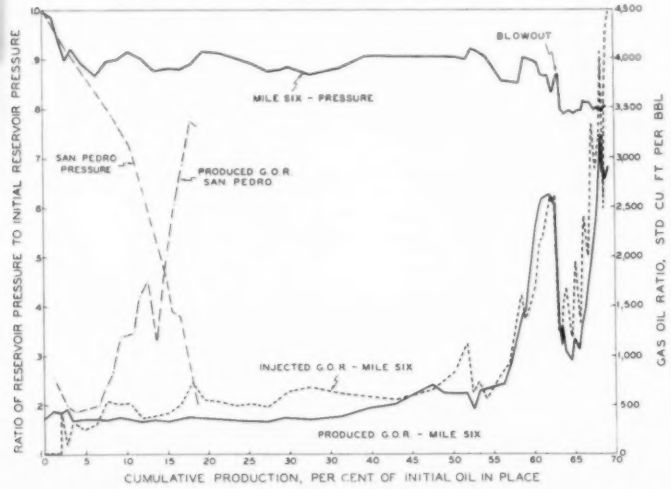

RATIO OF RESERVOIR PRESSURE TO INITIAL RESERVOIR PRESSURE
GAS OIL RATIO, STD CU FT PER BBL
BLOWOUT
MILE SIX - PRESSURE
SAN PEDRO PRESSURE
PRODUCED G.O.R. SAN PEDRO
INJECTED G.O.R. - MILE SIX
PRODUCED G.O.R. - MILE SIX
CUMULATIVE PRODUCTION, PER CENT OF INITIAL OIL IN PLACE

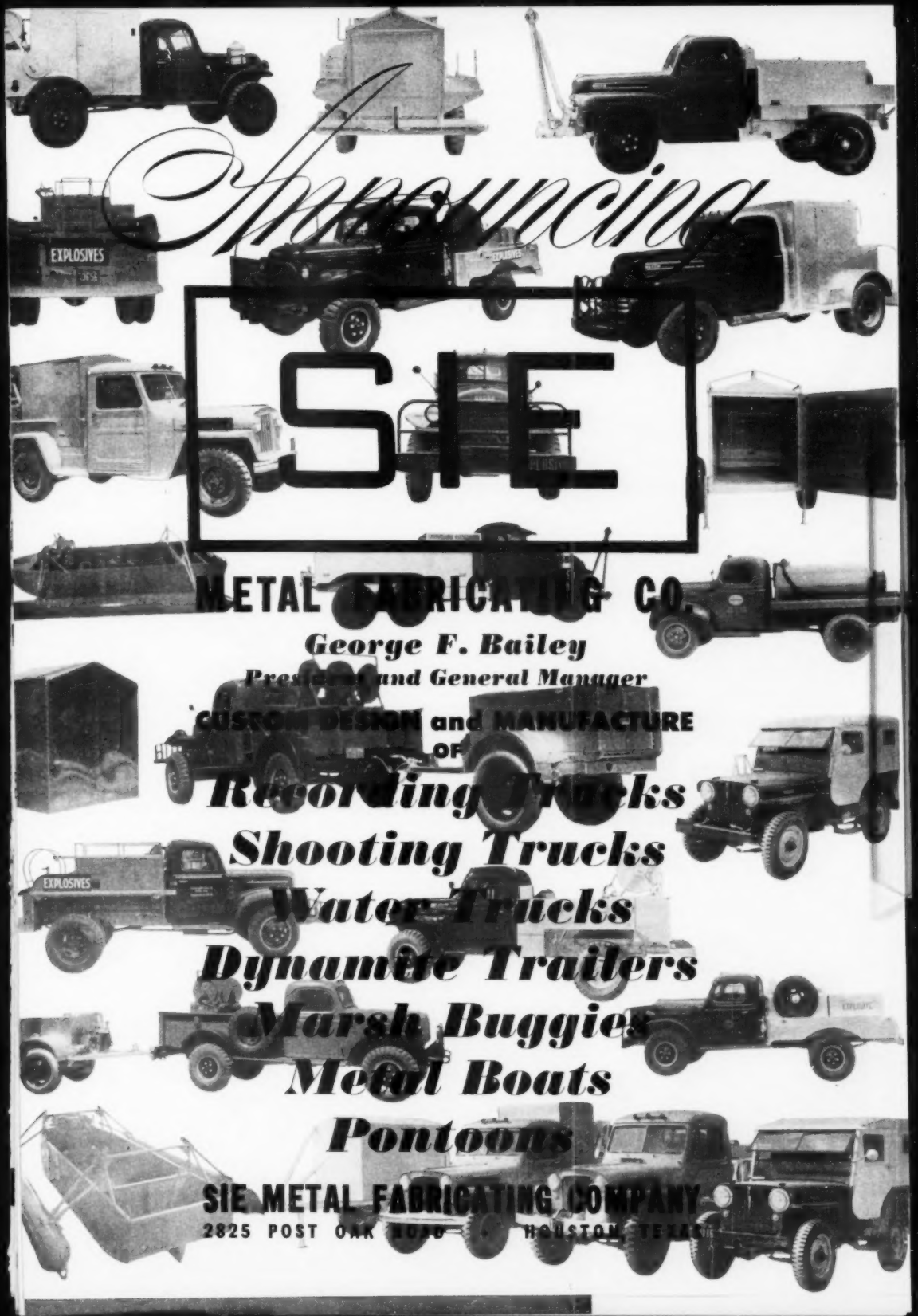
Fig. 3—Comparison of pressure-production history of Mile Six pool with that of Block "D" of San Pedro pool.

Drilling Operations

Faced with steadily rising postwar costs in both labor and materials, it became of increased importance to show greater efficiency in operations of the drilling rigs. Since early in 1947 the combined efforts of the drilling and engineering personnel have been directed toward increasing penetration rates and percentages of total rig time spent rotating on bottom. Despite a trend to deeper drilling with an increasing percentage of harder formations being encountered and the somewhat greater distances involved in rig moves, definite and continuous gains have been made in rig performance. Figs. 1 and 2 show graphically the progress that has been made. From these illustrations it may be noted that the footage per rig year in 1950 was 2.8 times that in 1946. Similarly, gains were obtained in rates of penetration.

The greatest single advance has been made by increasing the rates of penetration. This was made possible through systematic study and testing to determine the optimum combinations of weight, table speeds, and bits. Formerly, most formations were drilled under about the same conditions, and, usually, inadequate weight was applied to the bit. Under previous practices prolonged drilling frequently caused key seats and stuck pipe, and fishing jobs often resulted. As a result of the studies, proper bits were selected and operated under conditions of maximum effectiveness. It was found in most instances that much greater weight could be carried on the bit without causing excessive deviation. Long-tooth rock bits have found wide application, and, at the present time, evaluation of the jet-type rock bits is under way.

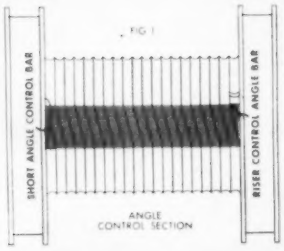
A rig-unitization and standardiza-

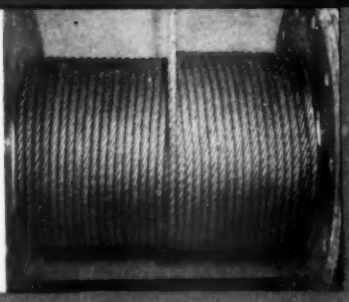

Announcing
SIE
METAL FABRICATING CO.
George F. Bailey
President and General Manager
CUSTOM DESIGN and MANUFACTURE OF
Recording Trucks
Shooting Trucks
Water Trucks
Dynamite Trailers
Marsh Buggies
Metal Boats
Pontoons
SIE METAL FABRICATING COMPANY
2825 POST OAK ROAD HOUSTON, TEXAS

A new improvement...hailed by Oil Men...as a Major and Important Development...!

LeBus Controlled Pyramid.

HOW THE NEW *LeBus Grooving System* WORKS





The above line drawing shows the 15% circumference of the drum taken up by the Angle Control Kick-Over segment of grooving as indicated by red shading.

In the photo above you see the wire line being wrapped on the Short Angle Control Kick-over Side of the drum. Note how the line crosses over within the same limited area on first, second and all succeeding wraps.

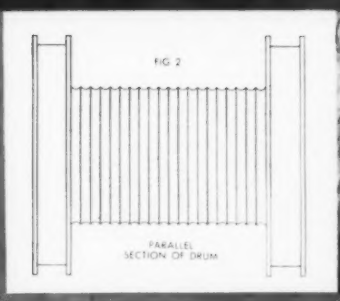
SAVE DRILLING TIME.....
SAVE WIRE LINE.....
SAVE ON CREW ACCIDENTS

Just as the title indicates—LeBus has now developed a system of spooling wire line where each wrap of line runs PARALLEL up to 85% of the circumference of the drum giving a maximum of true PYRAMID SPOOLING. This system has proved to be the most outstanding improvement in years for spooling wire line.

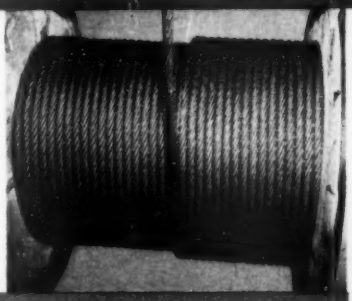
The helical angle which wire line has always been spooled in the past is now eliminated with the LEBUS CONTROLLED PYRAMID GROOVING AND SPOOLING SYSTEM. This system of wire line spooling has been developed by the use of new style angle control bars, which are placed against each flange of the hoisting drum. Angle control segments are installed all the way across the drum between the angle control bars as illustrated below in Fig. 1. This angle control section gives the wire line an abrupt turn (Fig. 1) within a limited area, creating parallel spooling (Fig. 2) for approximately 80 to 85% circumference of the drum. The System makes each layer of wraps form a groove for the next layer. The other 15% circumference is used for the ANGLE CONTROL KICK-OVER for making the line progress across the drum in the new line spooling method. This KICK-OVER of the line is in the same limited area on the drum on every layer. This new system has completely eliminated the double wave and the majority of wireline whip which is common factor in helical spooling. With helical spooling, it was difficult to actually get true PYRAMID SPOOLING. The maximum of true PYRAMID SPOOLING is attained with the LeBUS CONTROLLED PYRAMID GROOVING AND SPOOLING SYSTEM. Grooving the drums with this new system further prevents pinching, squeezing, crowding and mis-shaping of the wire line, all of which happens when your line is coiled on a plain or flat drum.

The controlled contact and even loads of a LeBus CONTROLLED PYRAMID GROOVING and SPOOLING SYSTEM means LONGER LIFE for Wire Line plus SAFER AND MORE ECONOMICAL DRILLING OPERATIONS.

• WIRE LINE GROOVING & SPOOLING SYSTEM



This line drawing shows the back side of the drums with the Parallel Grooved Segment running parallel with the Flanges of the drum.



This photo illustrates the Wire line being spooled on the parallel side of the drum. Note how evenly this line is being spooled. The even spooling is due to the fact that each layer of line forms a groove for the succeeding layer of line.

COMPLETE SALES & SERVICE EVERYWHERE

•

SALES REPRESENTATIVES

CALIFORNIA AREA:
Coastal Engineering
Sales & Service
P. O. Box 1618
Bakersfield, Calif.

PERMIAN BASIN AREA:
Kenneth C. Slough
Sales Only
612 West Kansas
Midland, Texas

ROCKY MT. and CANADA AREA:
Fred S. Dewel Specialty Co.
Sales & Service
Casper, Wyoming

OKLAHOMA AREA:
M-C-M Machine Works
Sales & Service
P. O. Box 4583
Oklahoma City 9, Okla.

ARK.-LA.-MISS.-E. TEX. AREA
Spencer Harris Machine Tool Co.
Sales and Service
Gladewater, Texas
Magnolia, Arkansas

ILL.-IND.-KY. AREA:
E. E. McCoy and Son
Sales and Service
Grayville, Illinois

GULF COAST and OLD MEXICO AREA:
Petroleum Engineering & Tool Company
Sales & Service
5710 Harvey-Wilson Drive
Houston, Texas

EXPORT AGENTS:
Hunt Export Company
Sales Only
Room 2503, 19 Rector St.
New York, New York

SERVICE INSTALLATION SHOPS

LeBus Rotary Tool Works, Inc., Arkansas-Louisiana-Mississippi-East Texas Area, Longview, Odessa, Texas; M-C-M Machine Works, Oklahoma City, Oklahoma; Petroleum Engineering & Tool Co., Houston, Texas, and all Gulf Coast; Coastal Engineering Company, Bakersfield, California; Fred S. Dewel, Casper, Wyoming; Spencer Harris Machine Tool Co., Gladewater, Texas, and Magnolia, Arkansas; E. E. McCoy and Son, Grayville, Illinois.

COMPLETE LITERATURE UPON REQUEST

LEBUS INTERNATIONAL ENGINEERS LIMITED

Executive Offices: 300 Wichita National Bank Bldg., WICHITA FALLS, TEXAS
SERVICE Control and Warehouse Stock: LONGVIEW, TEXAS

tion program is now practically completed. The steam engine and draw works are mounted on a skid-type substructure and moved as a unit. The steam and mud lines have been manifolded and mounted with the pumps on one skid. Pipe racks and loading ramps have been made portable. Blowout-preventer controls and grease racks have been built into the engine-house skid substructure. Boilers are mounted on skid bases. Two boilers are moved to the new location while steam is still maintained at the old location with the two remaining boilers. Misalignment couplings are used on steam and mud lines for ease of installation. Tool boxes with a standard list of hand tools are furnished, and all unnecessary equipment has been stripped from the rig. These and other improvements made possible a sharp reduction in rig installation and move time.

Other Improvements

A lubrication training course was developed for the purpose of improving the crews' knowledge in the essentials of proper machinery lubrication. This course consisted of lectures and discussion with full use made of training aids and actual equipment. Follow up in the field was made by assigning specific lubrication duties to each crew member. A reduction in down time for repairs and better machinery service has proved the value of this course.

In an effort to reduce down time for mud control and to minimize other drilling difficulties attributable to inadequate mud a similar training course was given in the principles of mud control. As a result of a better understanding by the field men, marked reductions in lost time due to mud conditioning and hole cavings have been effected. Time spent on fishing jobs, which were formerly often complicated by poor muds, has been reduced. More of the mud treating and testing is now done by the derrick man, and this has resulted in a savings in staff supervision.

Except for special instances, waiting on cement to set has been reduced to 12 hours. Trip time has been decreased through adoption of the "monkey board" system of racking drill pipe. Mouse holes are used for making connections with the result that connections are now made in less than half the time formerly required.

In 1950, continuous drilling operations were commenced. Prior to that time the rigs were shut down for Sundays and holidays. Seven-day operation not only increased rig footage per year, but, logically also increased drilling efficiency. In order for rig performance for former years to be comparable to 1950, all data given in Fig. 2 were corrected to a continuous operations base.

Each rig is thoroughly inspected quarterly by a two-man inspection team consisting of a drilling supervisor and an engineer, and prompt action is taken to correct deficiencies noted. For better maintenance and control of material, all drilling tools have been centralized in one warehouse. Inventories have been streamlined by equipment standardization. Quantity mud materials, such as barytes, bentonite, lime, and mangle (quebracho substitute), are procured from local sources at a great savings in cost.

Periodic Rig-move meetings are held wherein the drilling program is reviewed and schedules for the various rigs are outlined in advance as far as possible. This has resulted in closer coordination and better planning for all phases of the drilling operations.

Under present drilling practices, whereby holes are drilled in approximately one-half the time formerly required, key-seat difficulties have practically disappeared, and the number of protective casing strings has been reduced.

Particular attention is being given at this time to evaluation of oil-emulsion muds for increased penetration rates and longer bit life. Data are now being assembled to aid in more accurate predictions of formation pressures. With this information available it is planned to carry lighter weight mud when feasible. Thus mud costs should be reduced, and still further increased rates of penetration should be attained.

TABLE 1—PRODUCTION BY METHODS

Production method—	No. of wells	Bbl. prod. Per day	Bbl. prod. Per well day	Per cent of total wells	Per cent of total prod.
Flowing and gas lift	221	16,050	72.6	10	51.0
Central power	1,813	9,997	5.5	82	32.0
Separate unit	166	5,517	33.2	8	17.0
Totals	2,200	31,564	14.3	100	100

Production and Completion Methods

Production methods include both modern and old-type techniques. Some wells have been producing for over 60 years. Average daily production during 1950 was 31,564 bbl. per day from about 2,200 producing wells. The production statistics by methods are shown in Table 1.

In 1951 an economic study of marginal producers was conducted, and a total of 30 central power units and the 339 wells involved were proved to be unprofitable and have since been abandoned. Pumping jacks and pull rods are used for central power wells. A few old-type standard rig fronts are still in operation, and there are 180 modern Lufkin units now installed. Of these Lufkin units, 110 are electric powered and 70 are gas-engine driven.

Present practice is to equip all new pumping wells with gas-engine-driven beam units for test purposes; however, as soon as possible, electric power lines are run, and automatic time-clock-operate delectric units are installed.

A modernization program is presently in progress, and old and obsolete equipment is being replaced with more efficient equipment.

Casing and Cementing Techniques

Better casing and cementing techniques have helped to improve well performance and to decrease completion costs. Pressure maintenance of important reservoirs is started as soon as possible, and good primary cement jobs opposite pay sands (which are as much as 1,000 ft. thick) are necessary for successful control of expanding gas caps. Erratic performance in older pools was proven in many instances to be due to faulty cement jobs. Scratchers and centralizers on casing strings, inspection of casing before running, fresh cement modified with bentonite, and improved mixing practices have resulted in better cement jobs. Crews and supervisors have been instructed in the importance of following recommended procedures. The lighter-weight bentonite cement has allowed lifting long columns of cement without losing returns. On columns over 2,500 ft. long, multistage collars are used.

Oil-Base Mud

A pilot water-flood project to recover secondary oil from the prolific Parinas sand started in 1947. Because the sand contains bentonitic clay, and because of depleted pressure, ordinary mud was considered unsatisfactory. Serious lost circulation had been suffered when drilling through depleted Parinas in various pools. A locally prepared oil-base mud weighing 8 lb. per gal. proved the best of various drilling fluids used. Lost returns were eliminated, core recoveries increased, penetration rates increased, and bit life became longer.

Formerly, workovers to blank off gas from expanding gas caps by setting packers, or to squeeze off bottom water, had often resulted in poorer wells, even though gas or water was eliminated. The use of ordinary mud and the practice of washing wells with fresh water had been standard procedure. Use of oil-base mud made a startling improvement in most wells. Also, cleaner completions reduced cutting of pump seats and cups and the number of pulling jobs. Oil-base mud is now the standard fluid used on all workovers.

One important use for oil-base mud is in nitro-shooting operations. Shooting with solidified nitro-gel is done in thick, tight, low-pressure, "dirty" sands which need special techniques applied before commercial production can be obtained. By using oil-base mud with its easier controllability,

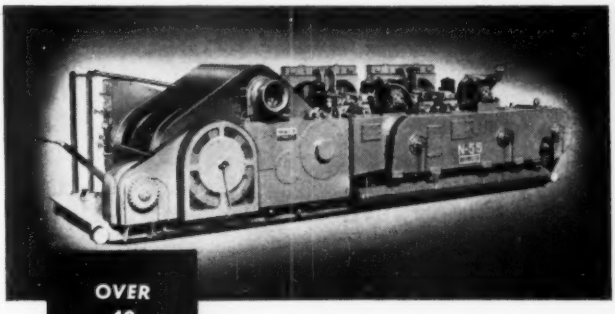
Glenn Peel says:

"I know what I'm getting with a Brewster Drawworks"

Glenn Peel, drilling contractor, has recently bought a new N-55 for 6,500′ drilling, and an N-4 for 4,500′ drilling, in addition to the other Brewster drawworks he owns. He says he knows what a Brewster drawworks will do to keep drilling schedules up and drilling costs down.

GLENN PEEL
Drilling Contractor

The N-55, Brewster's little big rig—drills to 6,500′—has 450 horsepower—is made with 2-engine or 3-engine compound—has overall width of 8′ for easy transportation.



OVER 40 YEARS EXPERIENCE

. . . And here's what you get in a Brewster drawworks: smooth, flexible control, with plenty of power where you need it; easy maintenance and standard replacement parts; rugged construction which will withstand years of heavy service; improved design, based on forty years' experience in manufacturing fine drilling equipment.

SUPPLY COMPANIES:

Apex Equipment Company, Bovaird Supply Company, Industrial Supply Company, Murray Brooks, Inc., Reams Supply Company.
IN CANADA: Rocky Mountain Supply Co.
Direct and through recognized export dealers.

Manufacturers of Fine Drilling Equipment ... Since 1910

Let us tell you about the new N-55 and other Brewster drawworks

BREWSTER DRILLING EQUIPMENT

THE BREWSTER COMPANY, INC., SHREVEPORT, LA.

the running of canisters and the cleaning out of gravel and calseal tamps have been facilitated. Also, lost-return troubles have been reduced. The wells are washed in with crude oil, and they clean up almost as soon as they are washed.

Finally, oil-base mud is being tried as drilling fluid in deep wells. It appears to have good and bad points. One interesting bad point is that considerable caving has been observed in some wells though no hydration is possible. It appears that the oil-base mud lubricates the shattered shales, and causes them to slough into the hole.

Well-logging and cementing services were made available in Peru in 1946, and operations have benefited considerably.

Of particular interest is the discovery of "emulsion" zone production. Unusual physical conditions of the sediments led to the adoption of lateral resistivity curves for easy field interpretation of fluid contacts. The apparent resistivities of the lateral curves showed sand zones—some as thick as 300 ft.—which were intermediate between clean oil and clean water. Previously, oil and water had been produced simultaneously from these zones, but bad casing-cement jobs were ordinarily blamed. Usually, cement squeezing failed to shut off the water or else shut off all production; with the lateral curves the emulsion zone was recognized, and important production is being obtained. Some nitro shooting has been done.

New Methods

Unceasing efforts to improve efficiencies and well performance have led to field testing of mud acid, wash acid, prima cord, oil squeezing, perforating new wells in oil or in oil-base mud, squeeze jobs with surface-tension-reducing and emulsion-breaking agents, and liner and perforation washing. Also, Hydrafracing has been tried, but as yet results are inconclusive.

Squeezing wash acid to dissolve carbonate scale in the tubing and casing and around the well bore looks very promising. The first well tested increased its production from 60 bbl. per day pumping to flowing over 300 bbl. per day oil through a choke.

Washing new wells in with formation water followed by crude oil has proven superior to washing with fresh water. In old wells, various combinations of cleanout techniques, such as shooting opposite liners with prima cord and then treating with wash acid, are being tried.

Reservoir Control

At the present time over half of the oil produced by International in Peru comes from pressure-maintained pools.

New wells, in areas which seem attractive for future pressure-maintenance operations, are completed with blank casing cemented through the producing horizon. The casing is then selectively perforated opposite the better sand sections with one or two holes per foot. The casing is left unperforated at all shale breaks. Thus, as the gas cap expands down dip, the upper zones in the producing wells can be isolated easily and economically by setting packers between perforated intervals.

Upstructure wells are selected as gas-input wells, and all sand sections are usually opened to receive gas. As far as possible, total withdrawals of oil, gas, and water are balanced with injected gas, and pressure decline is arrested.

Mile Six pool is one of the best examples of the benefits of pressure maintenance as it is nearer depletion than any other pressure-maintained pool in Peru. Although its performance has been extremely good, other pressure-maintained pools indicate that their per cent of initial oil in place recoveries will be as high. Fig. 3 compares the pressure-production history of Mile Six pool with that of Block "D" of San Pedro pool. This latter reservoir has evidently been produced by solution-gas-drive with little or no benefit from gravity segregation, and it has received no injected gas. The two pools are different in size, but sand conditions are very similar. Also they produce crude oils which were almost identical in solution gas-oil-ratio, shrinkage, and viscosity.

To September 30, 1951, approximately 69 per cent of the stock-tank oil initially in place in Mile Six has been produced, and it is still producing over 800 bbl. per day. Approximately 121 per cent of the produced gas from Mile Six pool has been returned to the reservoir. The San Pedro reservoir is nearly depleted by primary recovery, and only 19 per cent of the initial oil has been produced.

At the present time, approximately 45 per cent of the produced gas is being returned to pressure-maintained reservoirs, and most of the remainder is used for fuel (refinery and producing operations). A shrinkage of approximately 8 per cent is caused by absorption operations, and only 2.5 per cent of all produced gas is blown to the air. All pools are produced at or near their maximum efficient rates, and most of the oil is produced from reservoirs in which gravity segregation plays an important part.

Since 1941 more butane has been produced than was consumed on the local market. Aboveground storage for the large quantities involved was not practical, therefore the surplus has been injected to the gas cap of a Parinas sand reservoir. As a result of this injection over a period of years, additional oil was recovered. From the results obtained it appears that butane injection has application in secondary operations, and plans for its utilization are being made.

This announcement is neither an offer to sell nor a solicitation of an offer to buy any of these securities. The offering is made only by the Prospectus.

NEW ISSUE

100,000 Shares

El Paso Natural Gas Company

5½% Cumulative Preferred Stock
(Par Value $100 per Share)

Price $102 per Share
plus accrued dividends from December 1, 1951

Copies of the Prospectus may be obtained in any State in which this announcement is circulated from the undersigned and such other underwriters named in the Prospectus as may legally offer these securities in compliance with the securities laws of such State.

White, Weld & Co.

Stone & Webster Securities Corporation — Lehman Brothers

A. G. Becker & Co. Incorporated — Blyth & Co., Inc. — Glore, Forgan & Co.

Kidder, Peabody & Co. — Smith, Barney & Co. — Union Securities Corporation

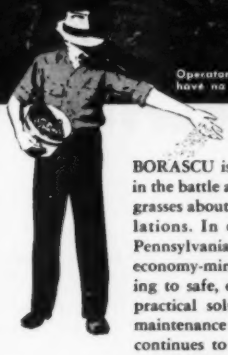
December 5, 1951.

BORASCU®
WEED KILLER

GIVES FREEDOM FROM FIRE HAZARD CAUSED BY WEEDS AND GRASSES IN EITHER "DRY" OR "WET" AREAS

Operators of this remote location need have no fear of weed and grass fires.

Red Lines, kept free of weeds and grasses by Borascu, are easily accessible for inspection and maintenance.



BORASCU is great for reducing labor costs in the battle against fire-hazardous weeds and grasses about all manner of petroleum installations. In oil fields from California to Pennsylvania—from Alberta to Venezuela—economy-minded production men are turning to safe, easy-to-apply Borascu; the most practical solution to their weed and grass maintenance problems. Once tried, Borascu continues to be used consistently by major and independent operators for economy and effectiveness. Users have found that non-corrosive, non-poisonous Borascu reduces the cost of weed problems up to 80% less than the cost of former methods. Application is so easy... just a man, a pail, and Borascu... no special equipment is required. And the results are long-lasting...one correct application can destroy vegetation and prevent future growth for 12 to 24 months, or longer! Borascu Field Men and Distributors are located throughout the oil fields of U.S. and Canada; ask them for details or write to us at once for your copy of our new Borascu Service Bulletin!

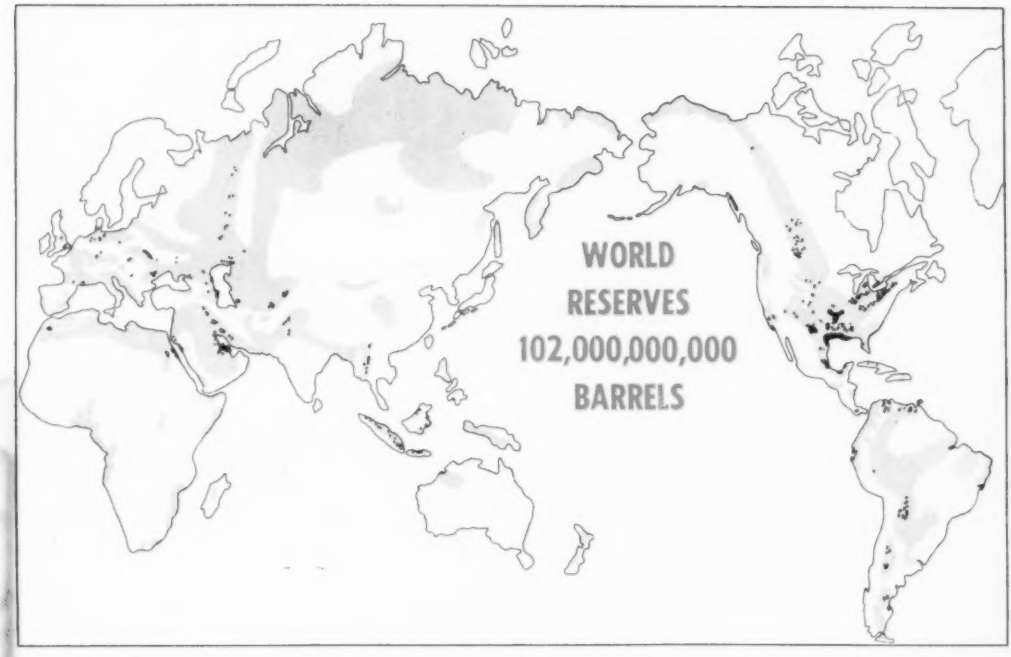
LITERATURE AVAILABLE ON REQUEST

BORASCU IS: ECONOMICAL • NONCORROSIVE • NONFLAMMABLE • NONTOXIC • NONSELECTIVE

PACIFIC COAST BORAX CO.

DIVISION OF BORAX CONSOLIDATED, LIMITED

510 WEST SIXTH STREET • LOS ANGELES 14, CALIFORNIA



World's oil-producing fields are small in relation to potential areas. Dark portions on map show location of actual production and shaded portions indicate possible areas.

Middle East Accounts for More Than Half of Global Petroleum Reserves

by Dahl M. Duff
International Editor

Areas which have added substantially to total during 1951 include Canada, Venezuela, Colombia, and Persian Gulf

AVAILABLE information now indicates world reserves of crude oil exceed 102 billion barrels and provide nearly a 25-year supply at current rates of production.

Substantial additions have been made to foreign reserves over the last year, particularly in Canada, Venezuela, Colombia, and the Middle East. Heavy demand for oil during the last 2 years has stimulated exploration and development. An even greater effort along this line is anticipated in the industry abroad during 1952.

The position of the Middle East as the world's greatest reservoir of oil is clearly shown in the reserves figures. Present reserves of the Persian Gulf region, including northern Iraq, are estimated to exceed 52 billion barrels.

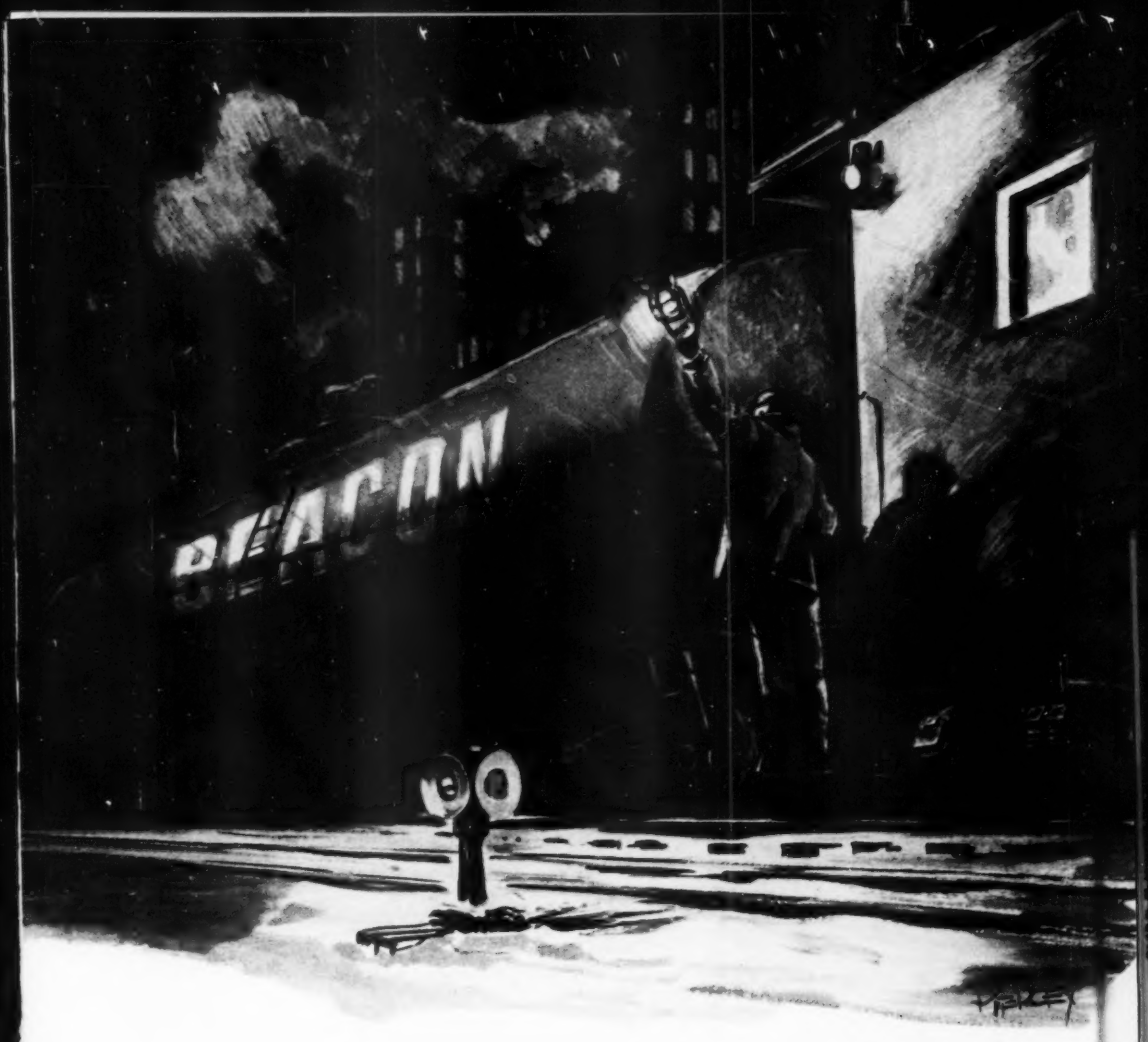
Even this total, according to some thinking in the industry, may be considerably on the low side. Two major discoveries, Safaniya and Uthmaniyah, have been made in Saudi Arabia. Important additions to reserves also have been recently indicated in Kuwait and Iraq.

The process of evaluating and defining various new areas will be taking place during 1952. In addition, there is much work of a purely exploratory nature under way in the Middle East. With the shutdown in Iran, more than two-thirds of the total production of some 1,800,000 bbl. daily in the Middle East is coming from two fields, Burgan and Abqaiq. Drilling now being carried out will in all probability make further important additions to reserves, either as field extensions or completely new areas.

Various estimates of total Middle East reserves range up to 70 billion barrels and in some cases even higher. It has been pointed out that the area actively explored thus far in the Middle East amounts to only about 130,000 sq. miles out of a total concession area of 850,000 sq. miles, including Iran.

North America Ranks Second

The estimates given in accompanying tabulation show that the Middle East has slightly more than 50 per cent of the total world reserves. Next largest is North America with about 28.5 per cent of the world's total. This is based on United States



Letting our light so shine

When your problem is getting petroleum products to market — Beacon really shines. Hundreds of companies have learned about Beacon's dependability and integrity — that's why Beacon is fast becoming the leader in the field. Yes, we're letting our light so shine — that you might see a better channel for the marketing of your petroleum products.

BEACON PETROLEUM COMPANY

HOUSTON • TULSA • ATLANTA

MARKETERS OF NATURAL GASOLINE, BUTANE-PROPANE, MOTOR FUEL, FUEL OILS

WHENEVER YOU SEE

furnaces like these, you can be sure they're* PETRO-CHEM ISO-FLOW *design

More than 935 are in operation throughout the world in the petroleum, chemical and allied industries . . . for all processes and for any duty, pressure, temperature and efficiency . . . and all Petro-Chem Iso-Flow furnaces are pre-eminently satisfactory.

PETRO-CHEM

ISO-FLOW FURNACES

UNLIMITED IN SIZE . . . CAPACITY . . . DUTY

PETRO-CHEM DEVELOPMENT CO., INC.

60 EAST 42ND STREET, NEW YORK 17, N. Y.

REPRESENTATIVES

World Crude-Oil Reserves

Country—	Estimated crude-oil reserves	Ratio: Reserves to production
Canada	1,600,000,000	32.6
Cuba	3,850,000	35.0
Mexico	1,400,000,000	18.3
United States	*26,121,000,000	11.6
North America	29,124,850,000	12.3
Argentina	340,000,000	13.5
Bolivia	22,000,000	37.6
Brazil	25,000,000	32.7
Chile	35,000,000	40.0
Colombia	450,000,000	11.6
Ecuador	25,000,000	9.5
Peru	170,000,000	10.5
Trinidad	240,000,000	11.5
Venezuela	10,000,000,000	16.1
S. America	11,307,000,000	15.6
France	25,000,000	12.0
W. Germany	275,000,000	28.4
Italy	2,500,000	17.1
Netherlands	46,000,000	9.1
U. Kingdom	3,000,000	9.1
Europe	351,500,000	20.3
Egypt	170,000,000	10.5
F. Morocco	5,000,000	8.5
Africa	175,000,000	10.4
Bahrein	300,000,000	27.3
Iran	13,000,000,000	101.7
Iraq	10,000,000,000	156.8
Kuwait	15,000,000,000	75.4
Qatar	1,000,000,000	55.3
Saudi Arabia	12,000,000,000	43.2
Turkey	20,000,000	182.0
Middle East	51,320,000,000	73.5
British Borneo	500,000,000	12.9
Burma	140,000,000	192.0
China	15,000,000	18.2
India	13,500,000	7.4
Indonesia	1,250,000,000	23.2
Japan	50,000,000	8.4
New Guinea	20,000,000	11.4
Pakistan	22,000,000	18.3
Far East	1,980,500,000	19.5
Austria	150,000,000	10.0
Romania	300,000,000	9.7
Russia	7,500,000,000	26.0
Other E. Europe†	112,000,000	11.4
Russia and E. Europe	8,062,000,000	23.4
World total	102,320,850,000	24.0

*Estimate as of January 1, 1951, by The Oil and Gas Journal. United States reserves as of January 1, 1952, will be shown in the Journal's Review and Forecast issue, January 28, 1952.

†Includes Albania, Czechoslovakia, Hungary, Poland, and Yugoslavia.

reserves as calculated at the beginning of the year and does not take into account additions expected to the United States total during 1951.

The widespread drilling and exploratory activity under way in western Canada has further enlarged the crude reserves of this region. Two year ago, Canadian reserves were estimated at 1,200,000,000 bbl. Petroleos Mexicanos, with the assistance of contract foreign operators, has made several notable discoveries during the last 2 years.

The important additions to reserves in South America during the last year have come in Venezuela, Argentina, and particularly Colombia. Texas Petroleum Co., Colombian Petroleum, and International Petroleum all have had success in their recent Colombian operations. Information on developments in Argentina is far less well-known but the government company, Yacimientos Petroliferos Fiscales, is reported to have made several discoveries in the northwestern part of the country. Venezuelan reserves are now believed to aggregate about 10 billion barrels, up about 500,000,000 bbl. despite the country's 1,700,000-bbl. daily production.

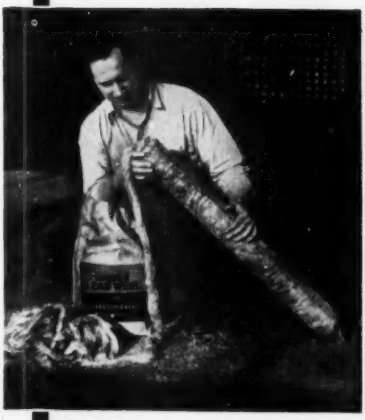
Europe's relatively small crude reserves have been enlarged during the last year as a result of development of the new Lacq field in France and continued work throughout Western Germany. Exploration in Italy and the Netherlands has resulted in gas discoveries; whether recently reported discoveries in Italy's Po Valley during the last year are of major significance remains to be seen.

Additional reserves are credited to Indonesia from successful work by Standard-Vacuum and the Texaco-California Standard affiliate in Sumatra. There is little reliable, up-to-date information on reserves behind the iron curtain. Much greater reserves are indicated in Austria on the basis of recent production performance. Best information is that the Romanian fields continue in a state of decline.

Eagle-Picher Lead Wool

Stops bottom water

Prevent costly shutdowns, keep bottom water out of your wells, with effective, economical Eagle-Picher Lead Wool. The fine, flexible strands fill cracks and crevices with a permanent, non-corrosive seal... save you time and money. Packed in convenient 50-pound sacks — easy to place in special cartridge-shaped Eagle-Picher Wire Containers sized to fit all casings. Order through your jobber.



THE EAGLE-PICHER SALES COMPANY
Since 1843
Metallic Products Division, General Office
Box 777, East Chicago, Indiana
Cincinnati · Kansas City · East St. Louis
Dallas · Houston
Member: Lead Industries Association

These 3 Eagle-Picher Bearing Metals meet most requirements

1. **Dreadnaught** — for extreme speed and heavy-duty conditions.
2. **Outlasta** — for medium speed and average-load conditions.
3. **Durable** — for low speed and light-duty conditions.

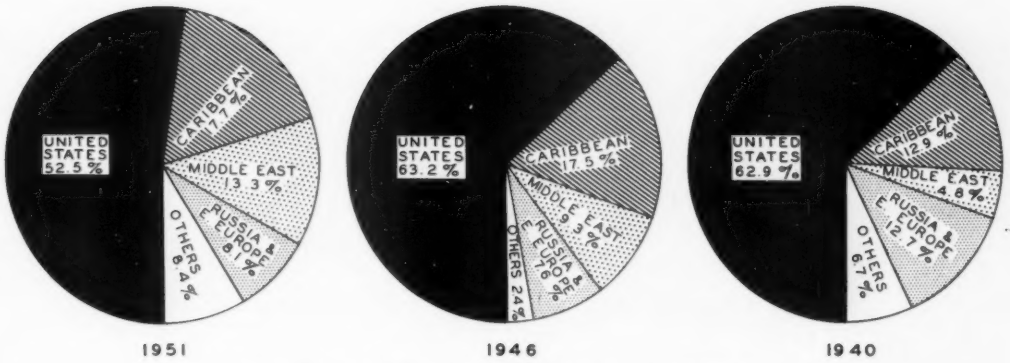
You're not taking a chance when Completion, Production and Maintenance procedures are guided by Radioactivity Well Logging.
Gamma Ray and Neutron Curves disclose every possibility and condition in old or new wells.

• *Don't take a chance, run a Radioactivity Log.*

Well Surveys, Inc.

TULSA, OKLAHOMA U.S.A.

LANE-WELLS COMPANY
UNITED STATES & CANADA
SEISMOGRAPH SERVICE CORP. of Delaware
MEXICO
GEOTECNICA, S. A.
BUENOS AIRES, ARGENTINA
PETRO-TECH SERVICE CO.
CARACAS, VENEZUELA



Here's how the world oil areas have divided total production since 1940.

World Production at All-Time High

by Dahl M. Duff
International Editor

Total hits nearly 11¾ million barrels daily, in spite of Iranian loss. U. S. contributes over half of 1951 increase

DESPITE the disappearance of Iran from the ranks of major world producing areas, world-wide output of crude oil in 1951 rose to a new all-time high, gaining slightly more than 12 per cent over 1950.

The world daily average during 1951 amounted to approximately 11,700,000 bbl. and compares to 10,437,200 bbl. the previous year. This increase of 1,264,000 bbl. daily is greater than the total current production in Oklahoma and Louisiana combined.

Of the total increase, about 740,000 bbl. daily was contributed by the United States. Estimated domestic production in 1951 averaged approximately 6,143,000 bbl. daily, a new record. Total production in all foreign areas, including estimated output in Russia and eastern Europe, averaged 5,559,000 bbl. daily in 1951, an increase of 524,000 bbl. daily over the previous year.

Iranian production averaged 662,000 bbl. daily up through June. The almost complete shutdown in what had been the world's fourth largest producing country began in July, and as a result its daily average output for the year was approximately 350,000 bbl. daily. The Iranian loss, spread over the entire year, thus amounted to somewhat more than 300,000 bbl. daily.

Although the Iranian nationalization will continue to be seriously felt for some time, further gains in world production can be anticipated in the year ahead. The performance of the industry during the latter part of 1951 demonstrates its ability to shoulder the Iranian burden without shortages and curtailment of consumption.

A 10 per cent increase in 1952 demand throughout the non-Communist world would mean the additional production of 1,075,000 bbl. daily next year, assuming no important changes in world stock levels. The fact that normal demand increases requires some 90,000 bbl. daily of new supply each month is sometimes not fully appreciated. With a 10 per cent demand increase next year, world production will be close to an average of 12,800,000 bbl. daily in 1952.

United States Up 13.7 Per Cent

One interesting feature of the 1951 production trend lies in the fact that for the first time since the end of the war the percentage increase in the United States was greater than that for the foreign areas. The 1951 gain in world production was 12.1 per cent; in the United States, 13.7 per cent; and foreign, 10.4 per cent.

Since 1946, domestic production has consistently shown a smaller increase than that outside this country, and during the slump of 1949, United States output actually dropped 8.6 per cent while foreign production showed a still healthy gain of 11 per cent. The reversal of this trend in 1951 was, of course, due in part to the replacement of the Iranian deficit. In particular, Texas allowables were raised the latter part of the year in an effort to offset the loss in Iran.

The United States percentage of the world production total rose slightly in 1951 to 52.5 per cent. This percentage in 1950 was 51.9 per cent. Prewar, the United States' share of world production was considerably higher, in 1940, for example, 62.9 per cent.

The year 1951 saw several significant developments in foreign production. By the middle of the year, Arabian American Oil Co. with its Saudi Arabian concession passed Creole Petroleum Corp. in Venezuela and became the world's No. 1 producing company. Saudi Arabia and Kuwait moved up to the positions of the world's fourth and fifth largest producing countries following the Iranian shutdown.

Saudi Arabia and Kuwait in the middle of the year picked up a large part of the loss resulting from the Iranian shutdown. Both these operations went on an all-out basis and in the latter part of the year were producing to the limit of their oil-handling facilities. The rest of the immediate Iranian deficit was made up by withdrawals from stocks, including those held by British companies, and by purchases, mostly of products, in the Western Hemisphere.

It is now apparent that the Iranian loss, insofar as crude-oil production is concerned, has been met without major dislocation in world markets. The action of the Texas Railroad Commission in cutting its recent allowables was based on continued high stocks in the United States.

Assuming no settlement which would bring Iran back into production, the task of meeting the extra load imposed by Iran's action becomes easier as the months go by. Field capacity, pipe lines, separators, and treating equipment are being built up elsewhere in the Middle East. Iraq, whose Kirkuk and Zubair fields are limited to pipe-line outlets, is due for a major expansion in 1952.

Zubair comes on production early in the year. With completion of the 30 and 32-in. line to Banias, Syria, Kirkuk will be able to move an additional 100,000 bbl. daily beginning in April. This will rise to the full 314,000 bbl. daily throughput by early 1953.

Additional equipment to produce and transport crude is also being added in Kuwait, Saudi Arabia, and Qatar. Refining capacity continues tight but this deficiency will be largely met by the end of 1952. These developments lend emphasis to the question as to whether Iranian oil could regain its position in world markets even if the nationalization issue were settled.

By the middle of next year, producing capacity in the Middle East should be 2,400,000 bbl. daily or more, excluding Iran completely. This assumes 900,000 bbl. daily in Kuwait, 950,000 bbl. daily or more in Saudi Arabia, about 475,000 bbl. daily from Kirkuk and Zubair in Iraq, and 75,000 bbl. daily in Qatar. The plan in Qatar calls for a buildup to a 5,000,000-ton annual capacity, equivalent to about 100,000 bbl. daily.

The highest production attained in the Middle East was 2,204,000 bbl. daily last May. The decline began in June under the impact of the closing of the Iranian industry. By September, production in the Middle East was down to 1,742,000 bbl. daily.

The most remarkable producing development in the foreign areas of the Western Hemisphere in 1951 occurred in Canada. Of all the more important oil countries (excluding those producing only a few thousand barrels daily) Canada showed the greatest percentage gain, with an output rising 71 per cent over 1950 to a daily average of approximately 134,000 bbl. daily in 1951.

Canadian production, most of which is coming from the postwar discoveries in Alberta, increased from 95,000 bbl. daily in January to an average of 164,000 bbl. daily in September. The increase was made possible by the earlier opening of the Interprovincial Pipe Line which for the first time gave Alberta oil access to markets in Eastern Canada.

Venezuelan Production Up

Venezuela showed a substantial increase in production amounting to 13.5 per cent. Output in this world's largest oil-exporting country climbed steadily throughout the year except in August when storms damaged electric-power facilities in the Lake Maracaibo region and caused a slight decline in production.

Venezuela is considered to be virtually at the top limit of its producing capacity. Steady small increases during 1952 are in prospect. Even if new concessions are granted—as now seems likely—it will be some time before this will have effect in production.

Colombian production during 1951 gained 12.6 per cent and now appears to be stabilized at about 106,000-108,000 bbl. daily. Several discoveries have been made in Colombia during the past year but most of them await evaluation, development, and the possible construction of outlets. Colombia's exported production is limited to the amount that can be carried through the two Caribbean pipe lines; expansion of the Barrancabermeja refinery to meet rising domestic requirements will call for some additional crude oil.

Mexico's production for 1951 is estimated to have averaged about 210,000 bbl. daily, a 6.3 per cent gain over 1950. Unofficial reports indicated production in Argentina increased about 5,000 bbl. daily during 1951 to reach a year's daily average of nearly 70,000 bbl. daily. Several small discoveries were made in the Mendoza area, and another near the Bolivian border.

Crude production of western Germany continued to gain. The increase was small compared to the world's major oil areas but the indigenous

World Crude-Oil Production

(Thousands of barrels daily)

Country—	1951 partly est.	1950	Per cent change, 1951 vs. 1950	1949	1948	1947	1946	1940	1928
Western Hemisphere:									
Argentina	69.0	64.0	7.8	61.9	64.8	59.9	56.4	56.5	24.9
Bolivia	1.6	1.6		1.9	1.3	1.3	1.0	0.8	
Brazil	2.1	0.8	163.0	0.3	0.4	0.3	0.2		
Canada	134.0	78.4	71.0	57.6	32.5	20.1	20.8	23.5	1.7
Chile	2.4	1.6	50.0	0.4					
Colombia	106.5	93.1	12.6	81.2	64.9	68.1	61.6	69.8	54.4
Cuba	0.3	0.3	—	0.4	0.3	0.7	0.7	0.3	
Ecuador	7.2	7.4	—2.7	7.2	7.0	6.6	6.4	6.4	3.0
Mexico	210.0	197.6	6.3	166.4	159.5	153.8	135.0	120.4	137.4
Peru	44.3	41.2	7.5	40.5	38.4	34.9	34.1	33.1	32.8
Trinidad	56.9	56.0	1.5	55.1	54.9	55.7	55.2	60.8	21.0
Venezuela	1,700.0	1,498.0	13.5	1,321.5	1,338.8	1,190.8	1,063.1	508.0	289.0
Total	2,334.3	2,040.0	14.4	1,794.4	1,762.8	1,592.2	1,434.5	879.6	564.2
Europe and Africa:									
France	5.7	2.4	138.0	1.1	1.1	1.0	1.1	1.4	1.4
French Morocco	1.6	0.8	100.0	0.3	0.2				
Western Germany	26.5	21.0	26.2	15.6	12.1	11.0	12.1	20.2	1.7
Italy	0.4	0.2	100.0	0.2	0.2	0.2	0.2	0.2	0.1
Netherlands	13.9	13.4	3.7	11.8	9.4	4.0	1.2		
Egypt	44.5	44.5		43.2	36.0	25.5	24.8	17.8	5.4
United Kingdom	0.9	0.9		0.9	0.9	1.0	1.1	0.3	
Total	93.5	83.2	12.4	73.1	59.9	42.7	40.5	39.9	8.6
Middle East:									
Bahrein	30.1	30.2	—0.3	30.1	29.8	25.8	22.0	19.3	
Iran	350.0	665.4	—47.3	561.8	518.5	422.0	402.2	181.0	119.0
Iraq	175.0	136.2	28.5	86.3	72.2	99.2	97.8	66.4	2.0
Kuwait	545.0	355.0	53.5	247.0	127.2	44.5	16.2		
Qatar	49.5	34.1	45.2	2.0					
Saudi Arabia	760.0	546.7	39.0	476.7	390.3	246.2	164.0	13.9	
Turkey	0.3	0.3		0.3					
Total	1,909.9	1,767.9	8.0	1,404.2	1,138.0	837.7	702.2	280.6	121.0
Far East:									
British Borneo	106.0	84.8	25.0	69.2	55.0	36.1	5.5	19.3	14.3
Burma	2.0	1.0	100.0	0.5	0.5	0.6	1.9	21.2	*24.0
China	2.2	1.5	46.7	2.0	1.8	1.1	1.4		
India*	5.0	5.0		5.3	5.3	5.1	6.0	6.3	(*)
Indonesia†	148.0	141.0	5.0	115.8	86.8	22.0	5.8	170.0	88.0
Japan	6.5	5.6	16.1	3.8	3.1	3.6	3.7	7.2	5.3
New Guinea	4.8	4.8		4.7	0.4				
Pakistan	3.3	3.3		2.0	1.2	1.0	(*)	(*)	(*)
Total	277.8	247.0	12.5	203.3	154.1	69.5	24.3	224.0	131.6
Total, foreign less Russia and E. Europe	4,615.5	4,138.1	11.5	3,475.0	3,114.8	2,542.1	2,201.5	1,424.1	825.4
Estimated Russia & E. Europe:									
Austria	41.0	34.0	20.6	20.0	17.0	15.9	15.7	7.7	
Romania	85.0	85.0		85.0	93.4	78.0	86.3	108.0	84.3
Russia‡	790.0	754.0	4.8	660.0	600.0	543.0	449.0	608.0	234.0
Other E. Europe¶	27.0	23.8	13.5	21.0	15.2	17.1	20.9	20.4	15.3
Total	943.0	896.8	5.1	786.0	725.6	654.0	571.9	744.1	333.6
Total foreign	5,558.5	5,034.9	10.4	4,261.0	3,840.4	3,196.1	2,773.4	2,168.2	1,159.0
United States	6,143.0	5,402.3	13.7	5,046.4	5,519.6	5,087.6	4,750.5	3,697.3	2,463.0
World total	11,701.5	10,437.2	12.1	9,307.4	9,360.0	8,283.7	7,523.9	5,865.5	3,622.0

*Pakistan included in India prior to 1947; both included under Burma for 1928. †Western New Guinea listed separately. ‡Includes estimated Sakhalin. ¶Includes Albania, Czechoslovakia, Hungary, Poland, and Yugoslavia.

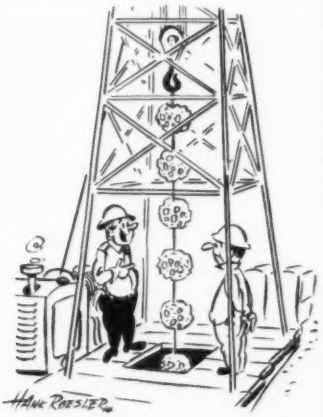
production of western Germany is important to the country itself and a benefit to its internal economy. Most of the increase is due to the continued development of older discoveries, especially in the Emsland region.

Netherlands' production appears to be stabilized at a rate of about 14,000 bbl. daily from the single field, Schoonebeek. Considerable exploration has been in progress in this country, resulting in the discovery of some natural gas. Italy's crude-oil production continues relatively minute since the drilling in the Po Valley has yielded mainly gas production.

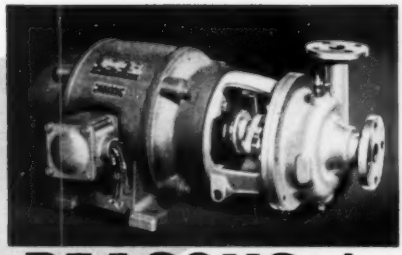
The small indigenous production of crude oil in France was more than doubled during 1951 as a result of the continued development of Lacq field in the southwestern part of the country. By the end of the year, Lacq was producing approximately 6,000 bbl. daily, and reports indicated the discovery of a new deeper productive horizon. Large sums of money have gone into the government-supported exploration in continental France as well as its overseas territories since the end of the war.

Production in Indonesia will be augmented in the spring of 1952 when the Texaco-California Standard affiliate brings its Minas field into commercial production, probably at an initial rate of about 8,000 bbl. daily. Present production in Indonesia is divided roughly equally between Standard-Vacuum Oil Co. and Royal Dutch-Shell.

In eastern Europe, the only fairly well authenticated production increase is that which the Soviet Mineral Oil Administration has made in Austria. Current reports indicate a 1951 output in excess of 40,000 bbl. daily. Production in Russia itself is estimated at slightly under 800,000 bbl. daily; the 754,000-bbl. daily figure corresponds to the tonnage figure which the Russians themselves announced for 1950.



"They're sponges—I figure it will revolutionize production methods."



5 REASONS why

AMPCO* Pumps are YOUR Best Buy

Ampco Aluminum Bronzes resist erosion, corrosion, deformation, cavitational pitting and wear. They have unusual properties of high yield and tensile strength and hardness with good castability. That's why Ampco Pumps give you these 5 important advantages:

1. Most accessible stuffing box known with hard shaft sleeve for long life. Permits choice of packings — internal or external liquid seal, or mechanical seals.
2. Wearing rings provide greater wear- and erosion-resistant life, maintain efficient running clearances.
3. External and supporting members, as well as internal pump parts, are corrosion resistant.
4. Ampco Pumps resist the corrosive action of many liquids and atmospheres. Ideal for economical pumping under adverse conditions of corrosion, erosion by abrasives in suspension, cavitation and shock.
5. Corrosion-resistance is our business. Ampco engineers are experienced in the proper selection of alloys for your toughest pumping problems. Ask for their advice today.

Solve your corrosion problems with Ampco Pumps. Capacities up to 600 gpm. Close-coupled mounting or pedestal type for any drive.

AMPCO®

Ampco Metal, Inc.

Dept. OG-12 • Milwaukee 46, Wisconsin

*Reg. U. S. Pat. Off., Ampco Metal, Inc. West Coast Plant: Burbank, California P-5

PAGE FENCE - Since 1883

• AMERICA'S FIRST WIRE FENCE •

Defense against hazards which could hinder or stop production is a major function of Page Chain Link Fence, guardian of persons and property for more than 60 years. NOW is the time to consult the skilled Page Fence erecting firm near you, whose name we will send with fence data on request and who will submit cost estimates, no obligation. For information

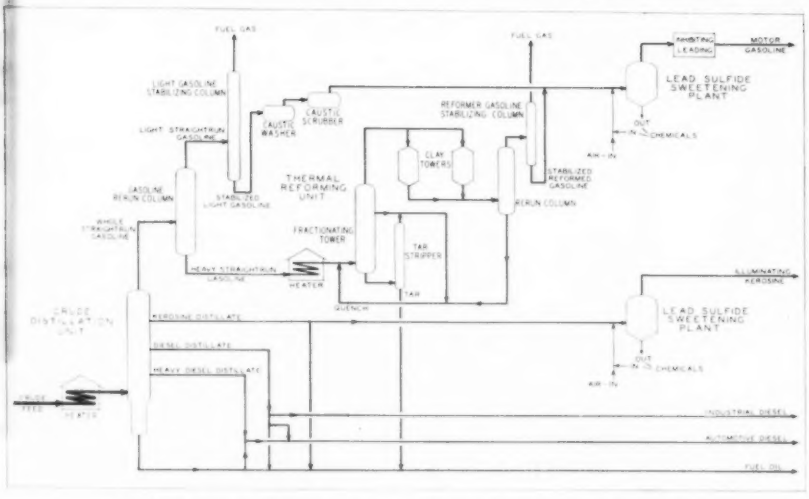
Write to PAGE FENCE ASSOCIATION in Monessen, Pa., Atlanta, Bridgeport, Chicago, Denver, Detroit, Los Angeles, Philadelphia, New York or San Francisco.

PRODUCT OF PAGE STEEL & WIRE DIVISION OF AMERICAN CHAIN & CABLE COMPANY, INC.

Rice fields being flooded near Km. 144.00. Line welded but not buried.

Route of Caltex-Fiat pipe line.

Caltex-Fiat Builds 97-Mile Pipe Line and



Simplified flow diagram of new Caltex refinery at San Martino di Trecate.

15,000-Bbl. Refinery in North Italy

by H. B. Nichols*

THE new refinery which is being built near Milan in northern Italy by the 50-50 Caltex-Fiat company, Sarpom, is designed to charge 15,000 bbl. per stream day of Saudi Arabian crude and will produce a line of basic petroleum products, including straightrun and reformed motor fuel, kerosine, automotive and heavy diesel, and residual fuel oil.

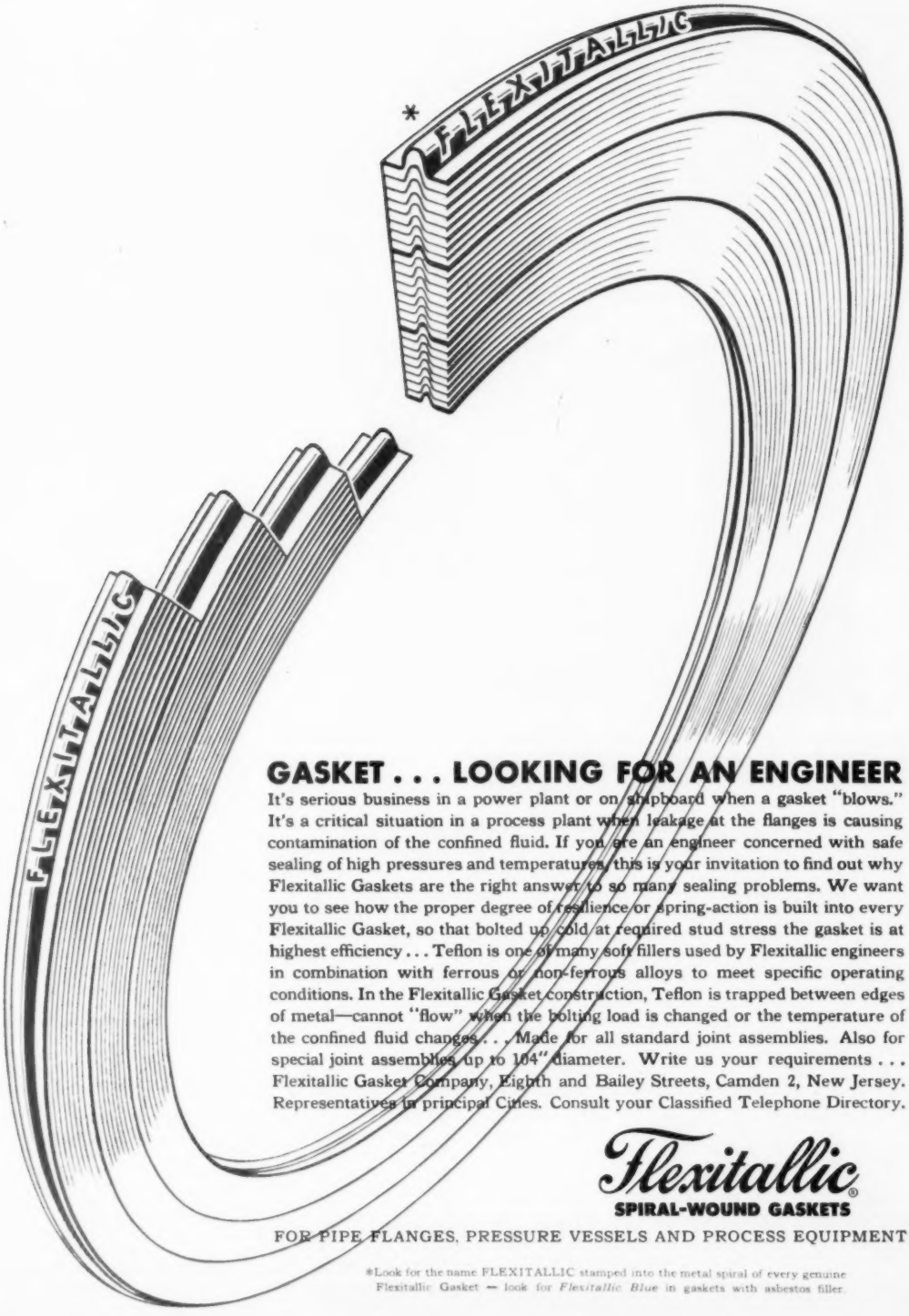
Process equipment in the new refinery is of conventional type. Besides the distillation unit, there will be a thermal reformer for upgrading gasoline production, caustic and lead sulfide treating, and the necessary auxiliary facilities. Approximately 801,000 bbl. of tankage will be provided at the refinery site.

Sarpom (Societa per Azioni Raffineria Padana Olii Minerali) was organized following the decision in 1947 of Caltex Oil Products Co. and Fiat—Societa per Azioni to joint interests for the purpose of importing, refining, and marketing petroleum products in Italy. Another company to handle marketing, Petrolcaltex Societa per Azioni, was established by the consolidation of Fiat's oil marketing facilities with the Italian interests of Caltex.

After a study of possible locations for the new refinery, it was decided to place the plant more in a central position to the markets rather than on the seacoast. This sacrificed ease of crude supply to what were felt to be the greater advantages of proximity to the large consuming areas of the Po Valley.

A companion project to the refinery itself therefore consists of the

*Vice president and director, California Texas Oil Co., Ltd., and of Bahrein Petroleum Co., Ltd.



GASKET . . . LOOKING FOR AN ENGINEER

It's serious business in a power plant or on shipboard when a gasket "blows." It's a critical situation in a process plant when leakage at the flanges is causing contamination of the confined fluid. If you are an engineer concerned with safe sealing of high pressures and temperatures, this is your invitation to find out why Flexitallic Gaskets are the right answer to so many sealing problems. We want you to see how the proper degree of resilience or spring-action is built into every Flexitallic Gasket, so that bolted up cold at required stud stress the gasket is at highest efficiency . . . Teflon is one of many soft fillers used by Flexitallic engineers in combination with ferrous or non-ferrous alloys to meet specific operating conditions. In the Flexitallic Gasket construction, Teflon is trapped between edges of metal—cannot "flow" when the bolting load is changed or the temperature of the confined fluid changes . . . Made for all standard joint assemblies. Also for special joint assemblies up to 104" diameter. Write us your requirements . . . Flexitallic Gasket Company, Eighth and Bailey Streets, Camden 2, New Jersey. Representatives in principal Cities. Consult your Classified Telephone Directory.

Flexitallic®
SPIRAL-WOUND GASKETS

FOR PIPE FLANGES, PRESSURE VESSELS AND PROCESS EQUIPMENT

*Look for the name FLEXITALLIC stamped into the metal spiral of every genuine Flexitallic Gasket — look for *Flexitallic Blue* in gaskets with asbestos filler.

construction of a 97-mile, 8-in. pipe line from a tanker-discharge terminal at Savona which is on the Mediterranean Coast 28 miles west of Genoa. Laying of this pipe line is now well advanced, and its construction will be entirely completed by the middle of 1952.

This pipe line will be the longest for the movement of crude oil in western Europe. The single pumping station will be at Savona where three electric - motor - driven, reciprocating pumps of 190 hp. each will provide a daily throughput sufficient to meet refinery input capacity.

Italian contractors have handled construction of the line, while the pipe was obtained from the Italian firm, Dalmine. For about the first third of its length, the line rises through hilly country. The remaining distance is through the flat and in places, marshy Po Valley.

Arrangements for the construction of the line involved the acquisition of right-of-way permits through an unusually large number of small, privately owned tracts. These numbered 1,258 along the entire right-of-way. In addition, the line's route crossed 164 canals, 66 rivers and streams, 32 roads and other thoroughfares, and 22 railroads.

The Savona terminal formerly was operated by Fiat's marketing company, Petrolea, and was among the properties merged into Petrolcaltex. The approximately 220,000 bbl. of tankage at Savona is being renovated, and some individual tanks provided with floating roofs. There is a small existing wharf but plans call for using a short offshore line for the discharge of crude from T-2 size tankers.

The 200-acre site for the refinery itself is near the town of San Martino di Trecate, about 20 km. (12.4 miles) west of Milan. The main Turin-Milan rail line borders the edge of the refinery property. Since all products will be shipped by rail or highway, extensive loading racks will be provided.

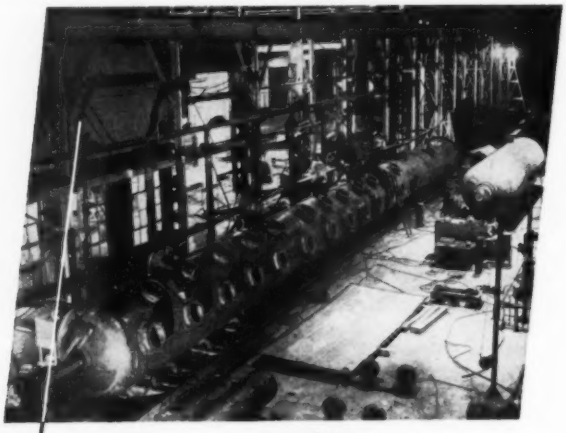
Calendar-day charge for the refinery will be 13,330 bbl. daily (650,000 long tons annually), the quantity specified in the Italian Government license for the project. On this basis, production will be approximately as follows: 2,730 bbl. daily motor gasoline, 820 bbl. daily illuminating kerosine, 860 bbl. daily automotive diesel, 1,250 bbl. daily industrial diesel, and 6,720 bbl. daily fuel oil.

The crude unit will contain a simple atmospheric distillation column capable of producing approximately 400° F.-e.p. gasoline overhead, sufficient side cuts for kerosine distillate and the proper blending stocks for automotive and heavy diesel gas oils, and a residuum which will be blended directly into industrial fuel. A fractionating column for rerunning the whole 400° F.-e.p. gasoline into two fractions, one a light gasoline of about 200° F. e.p. and the other a heavy gasoline for charging to the thermal reformer, will be included. This unit will have a charging capacity of about 5,500 bbl. per stream day. The light gasoline will be stabilized in a third column which will have a charging capacity of about 1,500 bbl. per stream day.

The thermal reforming unit will have a charge capacity of about 3,500 bbl. per stream day of heavy straight-run gasoline and will produce approximately 70-80 per cent yield of high-octane motor-gasoline blending stock. This U.O.P.-type unit will include clay towers for treatment of vaporized gasoline and fractionating equipment to stabilize reformer gasoline.

Treating facilities will consist of caustic washers for removal of H_2S, a regenerative caustic scrubber for partial mercaptan removal from stabilized, light straightrun gasoline, and a lead sulfide sweetening plant having a charge capacity of 4,500 bbl. per stream day. Facilities for the addition of oxidation inhibitors and tetraethyl lead also will be provided. Kerosine distillate will be treated in a lead sulfide sweetening plant having a charge capacity of 1,200 bbl. per stream day.

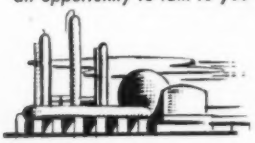
Steam requirements for the refinery will be supplied by two 60,000-lb. per hour water-tube boilers with superheaters. A refinery distribution system for 600, 150, and 20-psi. exhaust



* Everything

YOU NEED IN REFINERY EQUIPMENT . . .

Our complete facilities and unlimited experience in tank and refinery equipment fabrication are available to solve all of your equipment problems . . . Our long list of satisfied customers include some of the biggest names in the oil industry. Give us an opportunity to talk to you about your requirements.



McNamar Boiler & Tank Co.

REFINERY SALES DIVISION • BOX 868 • TULSA, OKLAHOMA

IT ALWAYS PAYS TO SPECIFY

LADISH

Controlled Quality

PIPE FITTINGS

Ⓛ

TO MARK PROGRESS

...you get full value for every fittings dollar

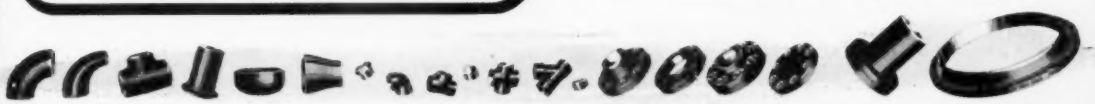
THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

LADISH CO.

CUDAHY, WISCONSIN
MILWAUKEE SUBURB

District Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago • St. Paul
St. Louis • Atlanta • Houston • Tulsa • Los Angeles • Havana • Toronto • Mexico City

The more critically you appraise value... the more you will appreciate Ladish Controlled Quality Fittings. For the ultimate economy of Ladish Fittings is assured by laboratory, engineering and manufacturing controls unsurpassed for thoroughness and rigid standards. From metallurgy through machining ... repeated tests safeguard the extra strength and soundness vital to long dependable service ... extra value you can always depend on from Ladish Controlled Quality Fittings.



PENBERTHY Liquid Level Gages

YOU CAN *Remove and Replace Without Shutdown*

Union connections between the gage and the valves permit removal of gage for repairs without shutting down the equipment. Just close the valves, uncouple the unions and remove the gage. The convenience of this is obvious. When glasses have to be replaced or repairs made, it is not necessary to work in an awkward position or to shut down. Another advantage: a gage needing repairs can be replaced immediately by a spare and the repairs made at leisure. There are many other reasons for the superiority of Penberthy Liquid Level Gages; ask for Catalog 35.

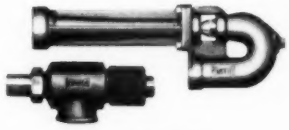
OTHER PENBERTHY PRODUCTS

PENBERTHY TRANSPARENT GAGE

Used to observe color and density of liquids under high pressures and or temperatures. Exceptionally sturdy construction —liquid chamber machined from solid block of metal. Ask for Catalog 35.

PENBERTHY CYCLING JET PUMPS

Automatically operated by air, gas or steam pressure . . . Will pump without clogging any liquid that will flow through pipes. Ask for Bulletin 5030.



PENBERTHY EJECTORS

A simple jet pump operated by air, water or steam. Needs no lubrication . . . will not get out of order. Made in wide variety of materials and special units developed to meet unusual conditions. Ask for Bulletin 512.

PENBERTHY EXPLOSION-PROOF SUMP PUMPS

Motor and switch totally enclosed. Underwriter approved for Class 1, Group D, and Class 2, Groups E, F and G hazardous location. Made of copper and bronze throughout. Ask for Bulletin 4929.

4672

PENBERTHY INJECTOR COMPANY
DIVISION OF THE BUFFALO-ECLIPSE CORPORATION
DETROIT 2, MICHIGAN
Established 1886 *Canadian Plant, Windsor, Ontario*

steam will be installed as well as a condensate-collecting system. Water will be drawn from several wells, and before use as boiler feed, treated in a softening plant. A separator system will be built to A.P.I. standards for waste disposal.

Other auxiliary facilities necessary to a complete new refinery will be built. These include systems for distribution of purchased electric power, refinery communications, utility air supply, and fire protection. Buildings to be erected will provide for offices, shops, warehouses, control laboratory, cafeteria, and washroom and change house. Four dwellings are being erected on the refinery property for the use of supervisory personnel.

Of the total of 801,000 bbl. of tankage at the refinery, 283,000 bbl. will be in crude storage to provide approximately 21 days' supply. The other refinery tankage will consist of 89,000 bbl. for gasoline shipping, 23,000 bbl. for kerosine shipping, 185,000 bbl. for fuel-oil shipping, and 160,000 bbl. for working tankage.

E. B. Badger & Sons, Ltd. (Great Britain) is handling most of the engineering design work for the Sarpom refinery and is serving as general contractor. The completed plant is expected to go on stream the latter part of 1952.

In the construction of both the refinery and the pipe line, all possible efforts were made to minimize the dollar outlay for equipment from the United States. This policy conforms to the recognized need of conserving dollar resources in foreign countries. The Sarpom refinery and pipe-line projects together cost the equivalent of about $20,000,000, and only about 6 per cent of the total spent directly for materials was for purchases in the United States.

Of the total purchases, some 61 per cent was made in Italy, and 33 per cent in the United Kingdom. The materials which it was found necessary to obtain in the United States included construction equipment, alloy piping and furnace tubes, heater burners, special instruments, valves and pumps, and turbine drivers.

The Sarpom refinery will be the fourth in Europe built since the end of the war in which Caltex holds a substantial or controlling interest. The others are Raffineries de Petrole de la Gironde near Bordeaux, France; Caltex Petroleum Mij. (Nederland) N. V., near Rotterdam in the Netherlands; and Refineria de Petroleos de Escombreras, S.A., near Cartagena, Spain. Caltex also is preparing to build a plant at Sidon, Lebanon, of a capacity of 13,000 bbl. daily for the production of diesel, fuel oil, and bunkers. In the Italian undertaking, Caltex and Fiat each have equal 50 per cent interest.

The Milan location is considered to be a strategic one for the distribution of petroleum products throughout the so-called industrial heart of Italy. The area north of the Appennine Mountains, important not only for its industry and commerce but also as a valuable agricultural district, has 42 per cent of the motor cars, 39 per cent of the trucks, and 40 per cent of the buses in all Italy. Within a radius of 150 miles of the Sarpom refinery site is found 87 per cent of the petroleum consumption of northern Italy. This percentage represents an estimated 2,100,000 tons annually (about 42,000 bbl. daily) in 1952—more than three times the capacity of the Sarpom facilities.

The recurrent shortages of coal in Europe have accelerated the trend toward the use of oil fuel in the industries of northern Italy. Italy has only minor indigenous production of either oil or coal, and from an economic standpoint, needs domestic refining to avoid the additional drain which is represented in oil-processing costs. It has been estimated that the operation of the refinery will result in a gross savings of more than $2,000,000 annually to the Italian economy. Another benefit lies in the fact that the tanker haul from the Trans-Arabian pipe-line terminus at Sidon, where crude for the Sarpom refinery will be loaded, is considerably shorter than would be the case if the products themselves had to be imported from Persian Gulf refineries via the long trip around the Arabian Peninsula and through the Suez Canal.

3 IMPORTANT REASONS FOR STANDARDIZING ON VICTOR WELDING AND CUTTING UNITS

VICTOR
Welding and Cutting Equipment Since 1912

REGULATORS for
acetylene
carbon dioxide
compressed air
hydrogen
liquid petroleum gases
medical gases
oxygen

TORCHES for
air gas
brazing
bunsen burner
descaling
flame cutting
flame hardening
hand cutting
heating
lead burning
machine cutting
preheating
soldering
surface hardening
welding

WELDING ROD for all uses

HARD-FACING alloys

BLASTING nozzles

PNEUMATIC regulator-filter-lubricator

CYLINDER MANIFOLDS for all types of cylinder gases

CYLINDER TRUCKS

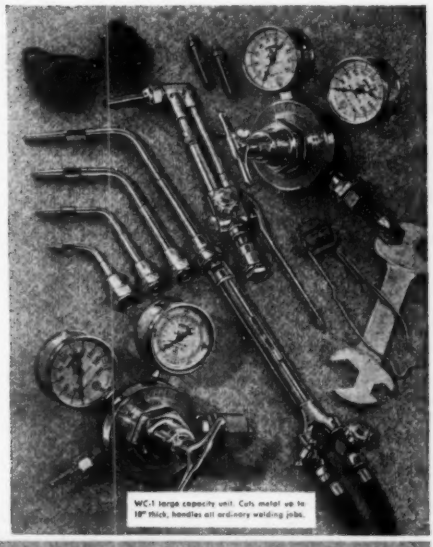
WRITE today for descriptive literature and name of nearest distributor.

Unlimited Opportunity for Expansion
All VICTOR welding and cutting units handle a wide variety of welding and cutting jobs. To expand them for new needs or special work—descaling, flame cutting, multi-flame heating, priming, etc.—just select the VICTOR tip, nozzle or attachment your job requires.

Low First Cost
When you use VICTOR you keep your investment in line with production . . . you buy only parts or attachments as needed . . . not a whole new outfit.

Low Operating Cost
Finally, because you can use the exact tip or nozzle needed for each job, you get better flame control, use less gas, and do better, faster work.

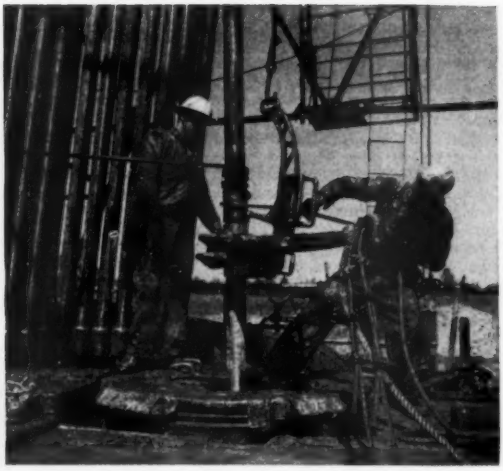
See for yourself why so many welders say it costs less to own and operate VICTOR. Ask your VICTOR dealer for a free demonstration TODAY.



WC-1 large capacity unit. Cuts metal up to 18" thick, handles all ordinary welding jobs.

VICTOR EQUIPMENT COMPANY

Seismograph shooting in Saskatchewan for Imperial Oil, Ltd.



Pulling drill pipe in Leduc-Woodbend field in Alberta.

STATUS REPORT ON

Canadian Oil and Gas Exploration

This study reveals that greatest activity continues to center in Alberta, where an estimated expenditure of 200 million dollars will have been made by the end of 1951 in the search for new oil

by John F. Caley*

Alberta

EXPLORATORY drilling in search of oil and natural gas is currently taking place in both eastern and western Canada (see map), but by far the greatest activity is to be seen in the province of Alberta where the Peace River region and the central and southeastern parts of the province are receiving particular attention.

The first half of 1951 witnessed a substantial increase in all phases of exploratory as well as development activity, and this has resulted in several oil and gas discoveries and extensions of established fields. During this period, about 527 wells comprising 441 development wells and 86 wildcat or exploratory wells were completed in Alberta. Of the total, 365 were oil wells, 29 were gas wells, and 133 were dry holes. Exploratory drilling resulted in 9 oil discoveries, 16 gas discoveries, and 61 abandonments.

Oil discoveries were made in the Upper Cretaceous Viking sand at Camrose and Morinville; in Lower Cretaceous sands at Dewdrop Lake and Wizard Lake; in D2 and D3 Devonian zones at Wizard Lake; and in the D2 zone at Drumheller, Caprona, New Norway, and Clive (see map). In addition, heavy oil of about 13° A.P.I. gravity was found in Cretaceous sands near Bonnyville. These 1951 strikes bring to 37 the number of fields and localities currently producing oil in Alberta.

Although it is yet too early to evaluate these new discoveries, it seems reasonable to expect that several of them will develop into fields, and one, Wizard Lake may take its place with Turner Valley, Leduc, and Redwater to become Canada's fourth major 100,000,000-bbl. recoverable reserve oil field. The discovery well, Texaco-Wizard Lake No. 2, about 5 miles southwest of Leduc field, obtained gas in commercial volume in the Viking sand of Upper Cretaceous age, and oil in the Lower Cretaceous and D2 and D3 Devonian reef zones. The well was placed on production from an 11-ft. section of the D3 zone. The first follow-up well, located ¼ mile south of the discovery, penetrated about 620 ft. of water-free oil-saturated D3 Devonian reef zone to establish the thickest D3 productive zone yet encountered.

Development and stepout drilling in Alberta during the first half of 1951 resulted in extensions of some fields and indicated extensions of several others. Among these might be mentioned a ½-mile eastward extension of D2 Devonian production at Leduc; a ½-mile north and northeastern extension of productive D2 Devonian at Stettler; a 2½-mile northwest and a 2-mile northeast indicated extension of Lower Cretaceous productive sand at Campbell; a 1-mile north extension of D2 and D3 Devonian production at Golden Spike; and discovery of oil in indicated commercial quantity in the D1 Devonian zone ½ mile east of the D3 discovery well; a ½-mile southeast extension of Lower Cretaceous production at Ellerslie; a ½-mile eastern extension of productive Lower Cretaceous sand at Barons; and a ⅜-mile southern extension of D2 Devonian production at Big Valley.

*Published by permission of the Director-General of Scientific Services, Department of Mines and Technical Surveys, Ottawa, Canada.

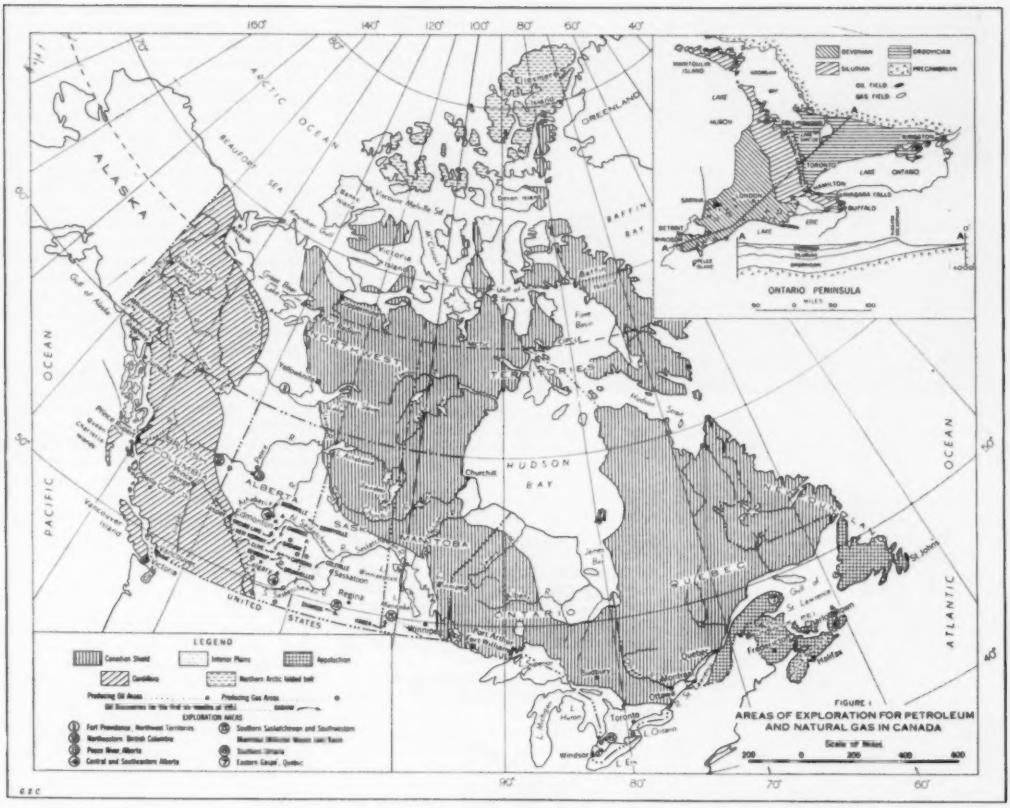


FIGURE 1
AREAS OF EXPLORATION FOR PETROLEUM AND NATURAL GAS IN CANADA

Geophysical activity in western Canada reached an all-time high. Of a total of 145 crews operating in the three prairie provinces at the end of August, 108, comprising 98 seismograph and 10 gravity-meter crews were in Alberta; 1 gravity-meter, 1 magnetometer, and 28 seismograph crews in Saskatchewan; and 5 seismograph and 2 gravity-meter crews in Manitoba. Indicative of the great increase in geophysical activity is the fact that, at the time of the Leduc discovery in 1947, only 15 parties were at work; and that a peak of 65 parties was reached in 1948; 101 in 1949, and 120 by the middle of 1950. Present geophysical activity is second only to that of Texas, where about 193 crews were operating on July 1 of this year.

The number of drilling rigs operating in western Canada has now (September 30) reached about 200. Alberta has 173 rigs, of which 68 are on wildcat locations. Exploratory drilling in Alberta during the first half of 1951 totaled about 858,420 ft. (162½ miles) as compared with 412,311 ft. for the same period in 1950, and 120,942 ft. in 1947. Total footage, exploratory and development, was about 2,188,104 ft.

All this exploratory activity, together with development of previous discoveries will, by the end of 1951, represent an expenditure estimated at $200,000,000.

Progress Since Leduc

By way of further comparison, it is both illuminating and encouraging to reflect upon the progress made in Alberta since discovery of Leduc, in 1947, initiated the present search for oil and gas in the Plains region of this province. In addition to Leduc, 1947 witnessed the discovery of oil in Lower Cretaceous sands near Brooks, on the southern Plains. In 1948, five discoveries were made; two were in Lower Cretaceous sands; two, of which one was the Redwater major field, were in Devonian reef limestone; and one, the Pincher Creek wet-gas field, was in limestone of Mississippian age.

In 1949, the number of oil discoveries increased to 12. Of these, five were in Cretaceous sands, three in each of the D2 and D3 Devonian zones, and one in the Mississippian. This progress was maintained in 1950, with five discoveries in Cretaceous sands, two in the D2 Devonian zone, three in the D3 Devonian reef zone, one in Mississippian limestone (Rundle formation), and one in sands thought to be of Triassic age. In addition, important extensions of Leduc

THE AUTHOR

John Fletcher Caley, widely known Canadian geologist, graduated from University of Alberta in 1927 with the degree of B.Sc., subsequently receiving his M.Sc. from the same university and his M.A. and Ph.D. degrees from University of Toronto. After spending the summer of 1934 on field work for the Ontario Department of Mines, he joined the Geological Survey of Canada as an assistant geologist.

He has carried on field work in the provinces of Alberta, Ontario, Quebec, and New Brunswick, and is presently geologist in charge of the oil and gas division of the Geological Survey. Dr. Caley is the author of numerous published and unpublished papers and reports embracing stratigraphy, paleontology, ground water, geology of dam sites, etc. He is a Fellow of the Geological Society of America, a Fellow of the Royal Society of Canada, and a member of the Geological Association of Canada.

The Imperial Leduc, world's largest fresh-water tanker, transporting crude from Superior, Wis., pipe-line terminal of Interprovincial Pipe Line Co. to Imperial Oil, Ltd., Sarnia, Ont., refinery. Total pipe-line and tanker distance, 1,788 miles.

field were made by discovery of pools outside the main producing area of the field.

During the first 8 months of this year, 10 separate oil strikes were made in Alberta and, consequently, there seems every likelihood that the current year will equal if not surpass 1950 in the matter of individual oil discoveries.

Perhaps 95 per cent of Canada's oil production is from the province of Alberta. In 1947, the year of the Leduc discovery, western Canada had a production potential of about 24,000 bbl. a day; this has now been increased to about 195,000 bbl. a day, and represents about one-half of the nation's daily requirements.

Completion of the Interprovincial Pipe Line from Edmonton to Superior, Wis., late in 1950, and of two new lake tankers, which were placed in service at the beginning of the 1951 navigation season, permitted movement of Alberta crude to Ontario refineries at Sarnia, Clarkson, and Petrolia. This allowed for a substantial increase in production from Alberta wells. During the first half of 1951, Alberta production was approximately 18,792,600 bbl. (1 bbl. = 35 imperial gallons) as against 11,563,818 bbl. for the same period of 1950. About 90 per cent of this yield was from Redwater, Leduc, Turner Valley, and Lloydminster fields, named in order of present productive importance.

The continued increase in discovery rate, with consequent increase in productive potential, in the prairie provinces during the past 18 months is forcing a search for wider outlets and an expansion of existing transportation, storage, and refining facilities. These would permit movement of greater quantities of crude oil to established markets in eastern Canada and allow for greater production from individual wells.

Plans have therefore been made to increase the capacity of the Interprovincial Pipe Line from the initial 90,000 bbl. a day (Edmonton to Regina)—70,000 bbl. a day (Regina to Superior) to about 113,000 bbl. a day, by the immediate construction of five additional pumping stations. To accommodate the resulting increase in accumulated crude oil at the Superior terminus during the season closed to navigation, the present 1,800,000-bbl. storage capacity will be increased to a total of 4,400,000 bbl. It is also expected that construction of 10 additional storage tanks, each of 150,000 bbl. capacity, will be completed at Imperial Oil, Ltd.'s, Sarnia refinery by the end of 1951.

New Outlet

Further outlet for Alberta crude will be provided with completion this autumn of Lake Superior Refining Co.'s 4,000-bbl. a day refinery located near the Interprovincial Pipe Line terminus. This refinery, together with the additional storage capacity mentioned above, will be an important factor in maintaining production of Alberta wells at a maximum this winter when lake transportation to Ontario refineries is halted.

Refining capacity in western Canada was substantially increased during the first half of 1951, with the completion of two new refineries. British American Oil Co.'s new plant at Edmonton was officially opened in June; it has a capacity of 5,200 bbl. a day and its catalytic cracking unit will produce high-octane gasoline. Imperial Oil's Winnipeg refinery was also placed in operation in June. It was constructed at an estimated cost of $10,000,000, and its modern catalytic cracking unit is designed to process 10,800 bbl. of crude a day into high-octane gasolines, heating oils, diesel and bunker fuels, and asphalt.

Present refining facilities in Alberta are concentrated largely in Edmonton and Calgary about 200 miles apart. Plans have been made for erection of a modern processing plant in the vicinity of the town of Stettler, about 100 miles northeast of Calgary and a few miles north of the Stettler Devonian oil field. The refinery will cost an estimated $2,000,000, will have a capacity of 4,000 bbl. a day, and will be designed to process Stettler field crude into gasoline, kerosine, diesel, and fuel oil. Market outlet for these products will be in the general Red Deer-Stettler area, where the products should enjoy a freight advantage over those produced at either the Edmonton or Calgary refineries.

All this expansion and construction, however, will not long suffice in the face of Alberta's rapidly growing oil reserves, and still further outlets must, therefore, be reached. Several companies are currently interested in the possible construction of an oil pipe line from Alberta to the Pacific Coast and collection of engineering and economic data in this regard is now well advanced.

Two principal routes have been proposed; one, an all Canadian route from Central Alberta to Edmonton and thence via the Yellowhead pass and interior British Columbia to Vancouver, with an extension southward into the Pacific northwestern United States; the other, from the Edmonton district south to Calgary and Pincher Creek, west through the Crowsnest Pass, southwest to Spokane and Seattle and, finally, northward to Vancouver. These lines would each tap the same market in Vancouver and the Pacific northwestern United States.

Natural-gas discoveries of commercial importance were made at about 27 separate localities extending from southeastern Alberta to the Peace River district. Eleven wells found gas in sands of Lower Cretaceous age; six in Upper Cretaceous sands; four in both Upper and Lower Cretaceous beds; three in Devonian limestone; and three in limestone of Mississippian age.

Several of these discoveries deserve special mention. The Texas Co. 2 Majeau Lake, located about 50 miles northwest of Edmonton, found wet gas in the Rundle limestone (Mississippian). About 30 ft. of this formation was opened at depths of from 4,210 to 4,240 ft., and on flow tests the well rated between 9,000 and 10,000 M.c.f. of gas daily, with separator recovery of about 24 bbl. a day of 60°-A.P.I.-gravity condensate and some free water. This discovery is southeast of Barrhead, where oil was found in the top of the Mississippian in 1949.

Perhaps the most important single strike of the year was made late in May when A. G. Bailey Co. 1 Olds wildcat found wet gas in the D3 Devonian reef zone. The well is

located about 38 miles north-northeast of Calgary, and represents the deepest and most southwesterly occurrence of the Devonian reef zone yet known in the Alberta plains region. The upper part of the D3 reef zone was opened at 8,100-12 ft. and 8,118-21 ft. After treatment with acid, several tests were made and these indicated an open-flow potential of from 50,000 to 70,000 M.c.f. of gas and around 400 bbl. of 58°-A.P.I.-gravity naphtha a day.

A third important discovery was made when Shell Oil Co. 1 MacKid well, located about 15 miles south of Calgary, obtained gas with a high hydrogen sulfide content at rates up to 5,000 M.c.f. a day between depths of 8,490 and 8,580 ft. in the Devonian. The well completed drilling in Cambrian strata at a total depth of 10,501 ft., and was plugged back to 9,685 ft. Drill-stem tests in the Rundle limestone (Mississippian) indicated gas up to 400,000 cu. ft. a day at this horizon.

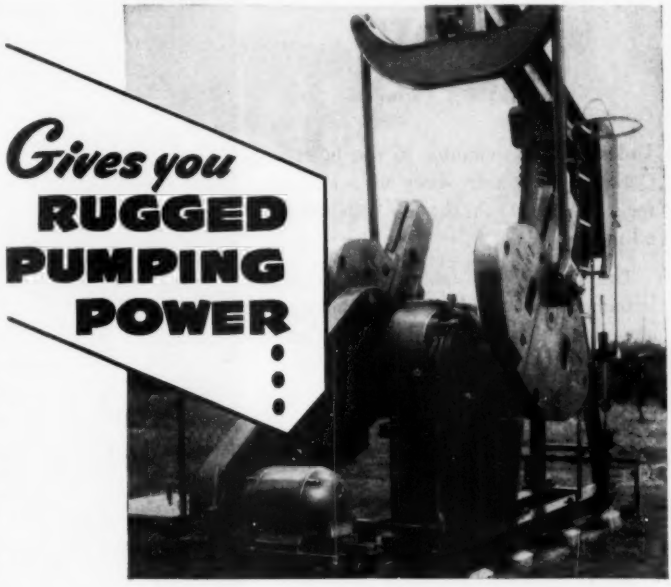
Saskatchewan

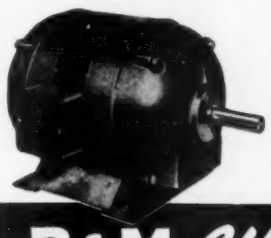
Exploration activity in Saskatchewan is now greater tha nat any previous time with virtually all the southern part of the province comprising about 50,000,000 acres under some type of exploratory permit or lease. Part of this increased activity results from recent discoveries of oil in the Williston basin in North Dakota and Montana. This structural feature extends into Saskatchewan (Moose Jaw syncline) and southwestern Manitoba, and these discoveries therefore enhance the possibilities in this area. About 30 geophysical crews are currently operating in Saskatchewan, and exploratory drilling is at an all-time high with about 19 rigs at work. It is estimated that $20,000,000 will be spent in the search for oil in Saskatchewan this year.

This activity has not been without some encouraging results. Royalite Oil Co., Ltd., and Albercan Oil Corp. 1 Coleville, about 100 miles southeast of Lloydminster field (see map), discovered heavy oil in basal Cretaceous sands at a depth of about 2,694 ft. where more than 60 ft. of water-free oil-bearing sand was penetrated. This well also encountered natural gas in commercial volume in the Upper Cretaceous Viking sand at about 2,275-95 ft. About 225 miles farther southeast in the Williston basin area, Shell 1 Dahinda (see map) obtained oil of about 20° A.P.I. gravity in fractured dolomite at a depth of about 4,694 ft. The well was acidized, and testing is continuing.

In the vicinity of Maple Creek, in the southwestern part of the province, Socony-Vacuum Exploration Co. and Western Prairie Exploration Co. 1 Tompkins (see map) encountered a substantial flow of natural gas in sands believed to be of Jurassic age at a depth of 3,631 ft. A show of light crude oil was also reported from these sands. This is perhaps the first evidence of the presence of other than "black oil" in Saskatchewan, and it raises speculation as to the possibility of future light-oil discoveries in this province.

Production of oil in Saskatchewan comes entirely from the Lloydminster region, which includes Lone Rock, Silverdale, Dulwich, Maidstone, and Dina-Marsden pools. During the first half of 1951, this area yielded about 579,985 bbl. of oil compared with 485,943 bbl. for the same period in 1950. Increased market facilities provided by establishment of new industries during the latter part of 1950 and in the current year have added greatly to the incentive for exploratory and development drilling in Saskatchewan. Sidney Roofing & Paper Co., Ltd., of Victoria, B. C., is erecting a $750,000 plant at Lloydminster, which will require an estimated 120,000 bbl. of crude oil a year. Dominion Products, Ltd., and Elro Asphalt Co. will also require the heavy crude in manufacture of their respective products. Conversion of several hundred locomotives in western Canada to oil burning by both Canadian National Railways and Canadian Pacific Railway, and the recent announcement of a contract to supply Canadian National Railways with 2,000,000 bbl. of fuel oil annually for a period of 5 years have greatly increased the demand for the heavy





▶ Yes, R & M All-Weather Motors have what it takes for *dependable* oil-country service . . . full-height end-protection—*largest* pre-lubricated, fully sealed ball bearings—high-velocity *end-to-end* ventilation—insulation of coils as well as phase groups—and complete "Weatherizing," *inside and out,* to guard against rust and corrosion. You get all these and other "extras" at the *standard-motor* price. So why pay more—why accept less? Write for free All-Weather Motor Bulletin 3019-C.

R&M *All-Weather Oil Country* MOTORS

ROBBINS & MYERS, INC., Motor Div., SPRINGFIELD 99, OHIO • BRANTFORD, ONT.

BANKS DON'T GET *Oil-Wise* BY REMOTE CONTROL

Unless a bank operates in the heart of Canada's oil country—sees oil, smells oil, feels oil—it *can't* do the job it should for oil men.

The Bank of Montreal, with 129 branches right in the Prairie Provinces alone, *can* do a job for American oil men whose interests focus on Canadian oil.

If you want advice and financing for any phase of an oil operation—from lease terms and taxation to pipelines and processing—it will pay you to contact the B of M. Because of our close connections with every part of this great industry, and our long experience in the U. S., we know how to help solve Canadian oil problems from the American oil man's point of view.

FOR THE PROMPTEST RESPONSE to your inquiry, write, phone, or see Gordon V. Adams, Special Representative, Bank of Montreal, Calgary Main Office, 140 Eighth Ave., West, Calgary, Alberta.

"MY BANK" TO A MILLION CANADIANS

B of M

BANK OF MONTREAL

Canada's First Bank Coast-to-Coast

550 BRANCHES • RESOURCES EXCEED $2 BILLION

New York . . . 64 Wall Street • Chicago . . . 27 S. La Salle Street • San Francisco . . . 333 California Street

Head Office: Montreal

oil. To meet this demand requires a substantial increase in development drilling, and plans are now under way to drill about 60 wells in the general Lloydminster region for this purpose.

Manitoba

Exploratory drilling for oil in Manitoba dates back to about 1886, and in the following 4 years a total of five wells, the deepest not exceeding 2,000 ft., were completed and abandoned. Little or no activity seems to have taken place between the years 1890 and 1907, but from 1907 to 1948 about 29 wells were put down. Two of these were completed as brine wells and the others abandoned. Three of the wells were reported to have shown traces of oil and natural gas. The following 2 years witnessed the first drilling in Manitoba below a depth of 5,000 ft., and in this period about 14 dry holes were drilled.

Interest in the oil possibilities of southwestern Manitoba increased greatly in 1950 when the Souris Valley Oil Co. 1 Downey, located near the international boundary, encountered a show of light oil in Mississippian limestone at a depth of about 3,223 ft. During the first half of 1951 this interest was further heightened by discovery of Manitoba's first recoverable oil near the town of Virden, and by discovery of oil in the adjoining Williston basin area of North Dakota.

Geophysical activity in Manitoba now includes five seismograph and two gravity-meter crews. Seven wells have been completed and four others are currently drilling, and it is confidently expected that several additional wells will have been completed by the end of 1951. Drilling completed during the first 8 months resulted in four abandonments and in the discovery of an indicated oil pool in Mississippian limestone at relatively shallow depth.

The discovery well, The California Standard Co. 15-18 Daly, about 9 miles east of the town of Virden (see map), completed drilling in the pre-Cambrian basement at a total depth of 5,368 ft. and was plugged back to 2,340 ft. A productive zone was found in the interval 2,200 to 2,340 ft. The well was acidized, pumping equipment installed, and on testing the well was reported to be capable of delivering from 8 to 10 bbl. of oil a day, with a water cut of approximately 65 per cent. The gravity of the oil is about 33° A.P.I.

The first follow-up well, California Standard 10-18 Daly, located ¼ mile south of the discovery well, found oil at about the same depth. Pumping tests on this well indicated a potential of around 7 bbl. net of oil daily, with a water cut of about 10 per cent.

A third well, California Standard 7-12 Daly, about 1½ miles southwest of No. 10-18, also obtained production in the Mississippian limestone. Pumping tests on this well gave a recovery of 20 to 25 bbl. of oil a day, with very little water.

British Columbia

During 1951 the search for oil and gas in British Columbia continued at the same high rate as in the previous year. Additional petroleum and natural gas permits were issued by the provincial department, bringing the total area thus held to around 11,000,000 acres. Most of this land is in the general Peace River region of northeastern British Columbia, but the New Westminster, Kootenay, and Cariboo districts as well as the Flathead area in southeastern British Columbia are also represented.

The general Peace River area of northeastern British Columbia is currently thought to offer the best prospects of success, and the greater part of the exploratory effort is at present being concentrated in this area. Recent discoveries of natural gas and indications of oil in commercial quantity on the Alberta side of this general region have enhanced the prospects in British Columbia, and this fact and the desire of some companies to develop sufficient gas reserves to warrant construction of a pipe line to the Pacific Coast have tended to focus attention on this region.

In this regard it is of interest to

Over years of service these Glucosates have an unexcelled record of satisfactory performance

WRITE ON YOUR LETTERHEAD FOR SPECIAL LITERATURE

D. W. HAERING & CO., INC.

GENERAL OFFICES
P. O. BOX 6037, SAN ANTONIO, TEXAS
CHICAGO OFFICE: 205 West Wacker Drive

note a recent announcement that 21 companies are currently planning joint exploration of some 500,000 acres of British Columbia Crown permits in the general Lone Mountain area about 60 miles south of Dawson Creek. Initial plans call for the drilling of several structure test holes to probe subsurface structural conditions beneath indicated surface features in the Lone Mountain district.

Although exploratory work in British Columbia has so far been largely geological, several wildcat wells were either drilling or completed during the first part of the year. Phillips Petroleum Co. 1 Diaber, in unsurveyed territory 70 miles northwest of Fort St. John, which commenced drilling in 1950, has reached a depth of around 11,000 ft. Another 1950 well, Allenbee Petroleums, Ltd., 1 South Brazeau, in the New Westminster district, has been abandoned.

Seven wells were spudded and completed during 1951 in the general Dawson Creek district; of these three have been capped as potential gas wells and four abandoned as unsuccessful. In addition, three wells, Pacific Petroleums, Ltd., and Allied Oil Producers, Ltd., 1 and 2 Fort St. John, located 25 miles north of the above gas wells, and Pacific Petroleums 1 Flathead, near the international boundary 125 miles south-southwest of Calgary, are currently drilling.

ARCCO
ARCCO ANUBIS
LIQUID GRAVITOMETER
...for PIPELINES, REFINERIES, GASOLINE PLANTS
This ruggedly built instrument of laboratory accuracy is ideal for quick checking and for continuous recording of Specific Gravity of liquids under line pressure. Changes in Specific Gravity of sample are recorded with a very minimum of time lag. Foreign liquids and gases are automatically purged from sample. No moving joints or stuffing boxes to cause friction or leakage. Temperature corrected, this precision instrument is adaptable to high pressures. Hundreds are in daily use in plants and refineries of major companies. Also available as a controlling instrument. Send for bulletin No. 111A.
AMERICAN
RECORDING CHART CO.
3113 E. 11th St. • Los Angeles 23, Calif.
Available for Early Delivery
SEND FOR BULLETIN No. 111-A

Northwest Territories

The presence of gently dipping limestones, dolomites, and shale of Middle and Upper Devonian age on the west arm of Great Slave Lake in the Northwest Territories has long been known, and oil seepages have been observed at Windy Point and elsewhere in this vicinity. Active interest in the oil possibilities of this area has been manifest in the last few years, and approximately 900,000 acres have been taken under exploratory permit from the federal Government.

The first exploratory well, Imperial Oil, Ltd., 1 Northwest Territories, was drilled during July and August of this year. The well was located about 1½ miles southeast of Fort Providence, some 350 miles southeast of Normal Wells field and about 550 miles northwest of Edmonton, and is Canada's most northerly drilling since development of Norman Wells field about 8 years ago.

The 1 Northwest Territories well, drilled to test the Devonian D3 zone equivalent, was completed at a total depth of 1,678 ft. Drill-stem test of interval 1,067 to 1,597 ft., presumably in the Middle Devonian Slave Point limestone, is reported to have given a natural-gas flow estimated at 400,000 cu. ft. a day. The well has been capped, and the drilling rig moved to a second location on Mills Lake about 30 mile to the west. At last report, the second well, Imperial 2 Northwest Territories was drilling at about 2,000 ft.

Norman Wells field, discovered in 1920 and developed to its present status during World War II, operates only for local requirements, which, during the first half of 1951, totaled 163,982 bbl. of crude oil.

Ontario

All producing fields in Ontario are located in the southwestern peninsula or interlake area where oil seepages were observed as early as 1858. Production has been continuous since about 1861, with cumulative yield of about 30,800,000 bbl. of oil to the end of 1950. Peak production was in 1894, when 829,104 bbl. of crude oil were recovered. Lowest production in 80 years occurred in 1945, when only 113,325 bbl. was recovered, but the yield has since increased to about 248,623 bbl. in 1950. Production for the first half of 1951 was about 95,030 bbl. of oil.

Commercial production is currently confined to the region bordering the north shore of Lake Erie west of the

Niagara escarpment, but encouraging showings of both oil and natural gas have been obtained at several other localities, and small quantities of oil have been recovered from Manitoulin Island. Only gas is produced in the Niagara Peninsula. West of London, both oil and gas are produced in commercial quantity. Most of the oil is from Middle Devonian limestone and from dolomite and dolomitic limestone of Middle Silurian age, but in Dover field the yield is from Trenton limestone of Ordovician age. The chief gas reservoirs are in rocks of Silurian age (Guelph dolomite, Salina dolomite, Grimsby sandstone, Whirlpool sandstone, and Clinton limestone), but gas is also obtained from Ordovician limestone in the Lake St. Clair district.

During 1951 most of the exploration in Ontario was in the general region southwest of London and more particularly in the district adjacent to the St. Clair River, between Sarnia and Chatham. Three gravity-meter parties were active in this area. In addition, considerable interest was shown in the oil possibilities of the Bruce Peninsula, and one unsuccessful wildcat well was completed in that part of the province.

Complete figures on drilling in southwestern Ontario are not at hand, but available data indicate that a minimum of 108 wells of all types had been completed by June 30. Of these, 67 were gas wells; 1 was an oil well, and 40 were dry holes. Of the 67 gas wells, 52 were in the Haldimand-Welland gas area of the Niagara Peninsula, where production was obtained chiefly from the Medina sandstone and Clinton limestone (Silurian) at depths of 500 to 900 ft.; 13 were in Norfolk and Oxford counties, with yield mainly from the Medina sandstone at depths of 1,000 to 1,175 ft.; and two were in Lambton County, with production from the Salina dolomite (Silurian) at a depth of 1,900 to 2,040 ft. The oil well, located in Lambton County, obtained a small production from Devonian limestone at a depth of about 350 ft.

Ontario produced 11,150,804 M.c.f. of natural gas in 1950, an increase of about 3,000,000 M.c.f. over that of the previous year. During the first 6 months of 1951, production was 6,196,176 M.c.f. as compared with 5,338,384 M.c.f. in the same period of 1950.

Natural-gas production continues to be insufficient to meet the demand. Union Gas Co. of Canada, Ltd., imports relatively small volumes from the United States during the summer months, and this is placed in underground storage for use in periods of peak consumption in the winter.

Quebec

The search for oil in the Gaspe

Then we dismantled the unit

. . . FOUND IT AS GOOD AS NEW

- Unit 9B16-213, for 15 months of day and night outdoor service, was operated beyond its rated capacity to meet unforseen demands. It was replaced by a larger Standardaire Blower. The engineer of this plant asked that the hard working unit be sealed and returned to our factory so that he personally could observe the dis-assembly and measurements for wear.
- Main and Gate Rotors like new—interior of blower completely dry and free of oil—no wear in other internal parts.
- Timing Gears on Gate and Main Rotors—wear very slight—no increase in back lash could be detected.
- Axial clearance of Main Rotor Shaft Thrust-Radial Bearing, increased less than .0005"—other bearings in perfect order.
- Even at the extremely high peripheral speed of these gears, they were found to be very quiet in service.
- Standardaire Blowers are sturdy—precision built units with proved staying power.

Write for specific data—Dept. E55. Read Standard Corporation, 370 Lexington Ave., New York 17, N. Y.

AXIAL FLOW STANDARDAIRE BLOWER

BLOWER-STOKER DIVISION

READ STANDARD CORPORATION

NEW YORK · CHICAGO · ERIE · YORK · LOS ANGELES

CUT CORROSION PROBLEMS DOWN TO SIZE...

WITH TAPECOAT*

—the Coal Tar Coating in Handy Tape Form

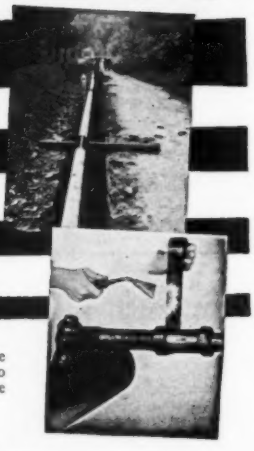
—Sized to the job

24" WIDTH

TAPECOAT — the economical coal tar coating for "cigarette-wrapping" mechanical couplings, large diameter pipe, joints, bends and drips.

18" WIDTH

TAPECOAT—the practical coal tar protection for "cigarette-wrapping" of large couplings, pipe bends, and joints on large diameter pipe.



6, 4, 3, and 2" WIDTHS

TAPECOAT — the distinctive, time-tested coal tar tape for spiral-wrapping welded field joints, service connections, pipe under streets and sidewalks, and pipe through building walls.

For more than 10 years, Tapecoat engineers have specialized in pipe joint protection. Call on them to help you meet your individual requirements. Write today for complete details.

The TAPECOAT Company

Originators of the Coal Tar Tape for Pipe Joint Protection

1539 LYONS STREET • EVANSTON, ILLINOIS

*Reg. U.S. Pat. Off.

Peninsula of Quebec dates back to 1860, when two shallow holes were drilled near the site of oil seepages. By 1903, 57 wells had been completed in eastern Gaspe. Many of these wells obtained shows of oil, and although some are reported to have yielded a number of barrels of oil either by pumping or bailing, none could be classed as commercial. Except for one well drilled in 1913, little activity seems to have taken place between 1903 and about 1938, but from 1938 to 1950 at least 11 dry holes were drilled. None of these, however, attained a sufficient depth to test all prospective zones.

Petroleum is known to occur in Silurian limestone at several widely separated localities. Both bituminous shales and oil seepages are known in the Lower Devonian shales and sandstones, and oil in noncommercial quantity has been recovered from wells penetrating Lower and Middle Devonian limestones and sandstones.

Interest in the possibilities of eastern Gaspe continues, and it is estimated that about 175,000 acres are presently under lease. Three exploratory wells are drilling. The 1 Tar Point well, about 10 miles southeast of Gaspe village, was spudded in in December 1950 and was drilling in the Middle Devonian-Gaspe sandstone at a depth of 6,125 ft. in July of this year. A show of oil was reported at a depth of 4,118 ft. in this well.

Quebec Oils' 1 Power Joncas Dome, about 30 miles southwest of Gaspe village, was started late in 1949. In August 1951 this well was drilling at a depth of 2,567 ft. in what appears to be the Lower Devonian-Grande Greve limestone.

A third well, Continental Gaspe Deep Test No. 1, commenced drilling about July of this year, and at last report was in the Grande Greve silicious limestone at a depth of 660 ft. The well is located on the Galt Brook Dome about 17 miles west of Gaspe village.

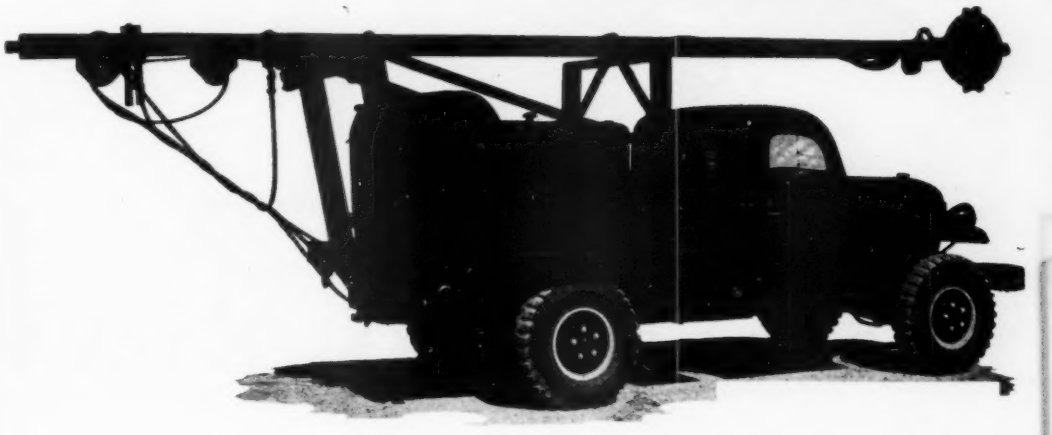
New Brunswick

Production in New Brunswick is from Stoney Creek oil and gas field discovered in 1909 about 9 miles south of the city of Moncton. About 16,884 bbl. of 37°-A.P.I-gravity oil and 342,405 M.c.f. of natural gas were recovered in 1950. Production in the first half of 1951 was 7,505 bbl. of oil as against 8,231 bbl. in the corresponding period of 1950, and 157,764 M.c.f. of natural gas compared with 183,971 M.c.f. in the same period of 1950.

The yield is from sandstone interbedded with dark grey shale of the Albert formation (Mississippian) at depths ranging from 1,000 to 3,500 ft.

No exploratory wells were completed during the first half of this year.

Here's the Answer for SHALLOW WELL SERVICING!



COOPER – ALLIS-CHALMERS

Model B125-20 SKID WINCHES

For Servicing to 1,500 ft. of 2½" Tubing

Now a new COOPER—ALLIS-CHALMERS servicing winch for less money than most used equipment will cost.

In any kind of country — New York · Ohio · Kansas · Oklahoma · Texas · Colorado—these husky little units are proving that it is folly to waste time and money on worn out, used equipment in servicing shallow wells.

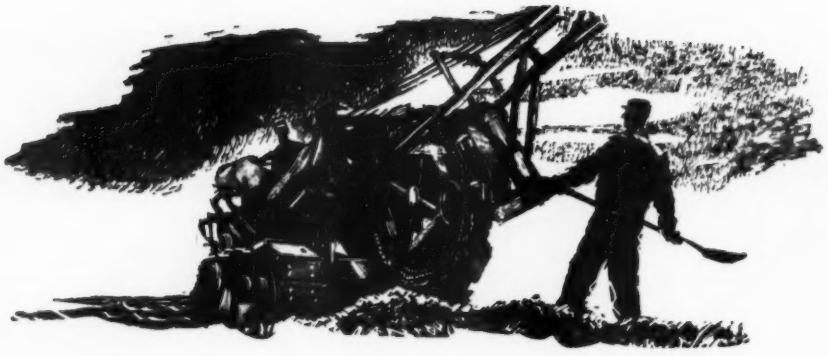
Powered by ALLIS-CHALMERS Model B-125 engine—the engine built especially for heavy duty stationary work.

Regardless of the depth of wells, there is a Cooper–Allis-Chalmers Winch of the right capacity to do the job economically.

FRED E. Cooper, Inc.

P. O. Box 1890 TULSA, OKLA.

Houston · Odessa · Los Angeles



Canada's **OIL** Bank

Ask the Royal about Canada's Oil. This bank has been operating in the Canadian oil fields since the earliest days. It has taken a leading role in providing assistance and encouragement to those responsible for the expansion of the industry. Its branches completely blanket the areas of active oil and gas development. Many of them are in the heart of the major producing districts. At Calgary the bank has a special department geared to provide information and render active assistance to oil and gas men.

Inquiries are invited.

★ ★ ★

United States Banks are invited to use the unequalled facilities of The Royal Bank of Canada in servicing the accounts of United States clients interested in Canadian oil development.

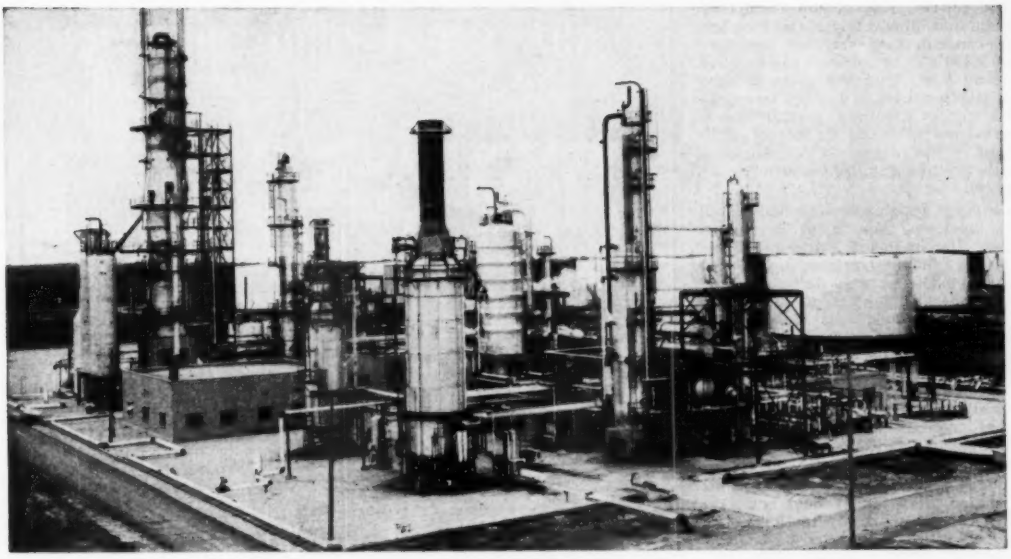
Address your inquiries to J. C. Mayne, Supervisor, Calgary, Alberta, or to Head Office, Montreal.

Branches in Calgary, Edmonton, Leduc, Devon, Redwater, Turner Valley and many other areas of active development. 57 branches in Alberta alone.

THE ROYAL BANK OF CANADA

HEAD OFFICE MONTREAL • OVER 750 BRANCHES IN CANADA AND ABROAD

ASSETS EXCEED $2,400,000,000



General view of processing equipment at the Winnipeg, Man., refinery of Imperial Oil, Ltd.

Winnipeg Refinery Designed to Produce Complete Product Range

This 12,000-bbl. per day plant incorporates an atmospheric and vacuum distillation crude unit, plus catalytic cracking for 3,400 bbl. of fresh gas-oil feed, and gas-concentration facilities

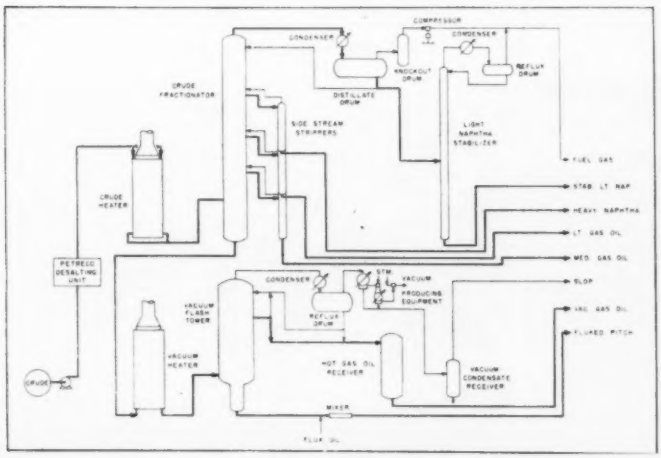


Fig. 1—Simplified flow diagram of the 12,000-bbl. per day atmospheric and vacuum unit at Winnipeg refinery.

THE story of Imperial's Winnipeg refinery is an integral part of the story of discovery of crude oil in Alberta, plus the problem of finding a market for this crude oil. Not long after the discovery of Leduc, studies were made of a pipe line to Regina, Sask. Before these studies had time to reach maturity, the rapid rate of discoveries of crude oil in Alberta indicated that the pipe line would have to be extended in order to provide a larger market for the crude. As a result of this, plans were eventually completed for the construction of the Interprovincial Pipe Line to Superior, Wis. Preliminary studies had already been made evaluating the economics of a refinery in the Winnipeg area.

The decision to extend the Interprovincial Pipe Line from Regina to Superior had a very favorable bearing on the economics of a refinery in Manitoba. Historically, Imperial's Manitoba market has been supplied by products shipped into the western half of the province from Regina refinery and into the eastern half of the province, which includes the city of Winnipeg, from the Sarnia refinery. With pipe-line crude available at Winnipeg, it was obvious that the historical sources of supply could not be made competitive with a refinery in the Winnipeg area.

In view of these factors indicating the necessity of a refinery, preliminary design studies were started in 1948 and continued through 1949. Many possible combinations of processes were studied and, after a complete analysis, it became evident that the best combination for Winnipeg was a 12,000-bbl. per calendar day

atmospheric and vacuum distillation crude unit, plus catalytic cracking and gas-concentration facilities designed for 3,400 bbl. per stream day of fresh gas-oil feed. This conclusion is based on meeting product demand and quality with a minimum capital investment and allowing for future additions to the processing equipment to raise product quality if and when required.

Process designs were started for all the operating equipment in August 1949. The engineering division of Imperial's manufacturing department prepared the process design for the atmospheric and vacuum unit. Universal Oil Products Co. was selected to prepare the process design of the catalytic cracking unit, since it had been successful in the development of a special type of small fluid unit. Imperial's engineering division also compiled process specifications covering the treating facilities and utility plant.

Contract was awarded to Canadian Kellogg Co. on January 23, 1950. Construction work in the field began in March, but little was actually accomplished until after the Red River flood subsided early in June. Had engineering work been more advanced and materials been on hand, the flood might have caused considerable delay. Fortunately, its effect was minor to the final outcome of the project.

Refinery Site and Layout

The refinery is located on a site approximately 8 miles from the center of Winnipeg on the Red River in East St. Paul and has access to both Canadian National and Canadian Pacific railways. The property covering 400 acres is very flat, presenting a problem from the standpoint of drainage.

Processing equipment is concentrated in one area and flow through the refinery has been arranged to minimize interconnecting piping. Crude from tankage located east of the processing area moves in a general west-

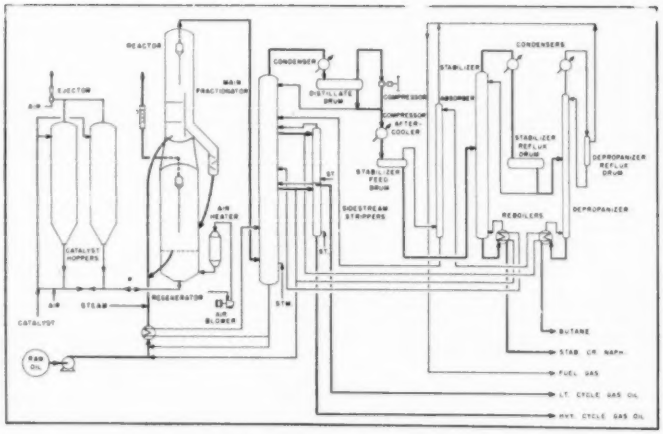


Fig. 2—Catalytic cracking and gas-concentration unit.

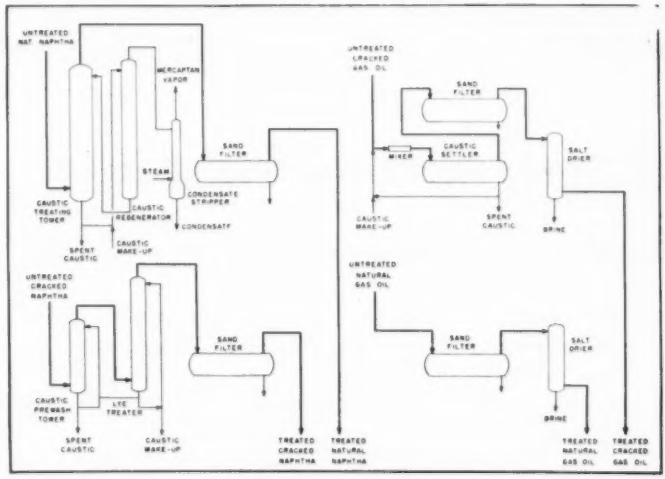


Fig. 3—Central treating plant.

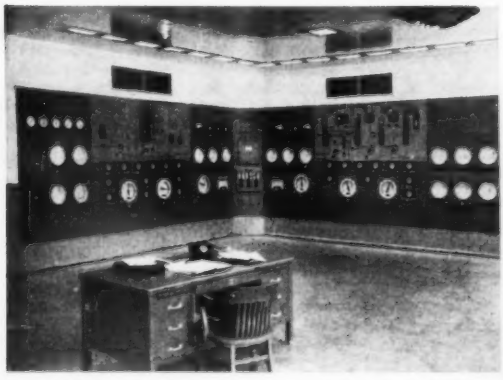


Fig. 4—Maximum use is made of control instruments at Winnipeg refinery. This shows the main control panel.

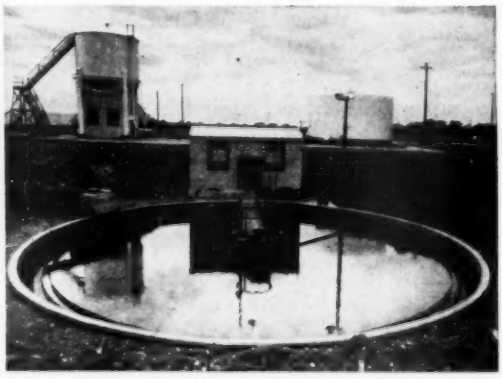
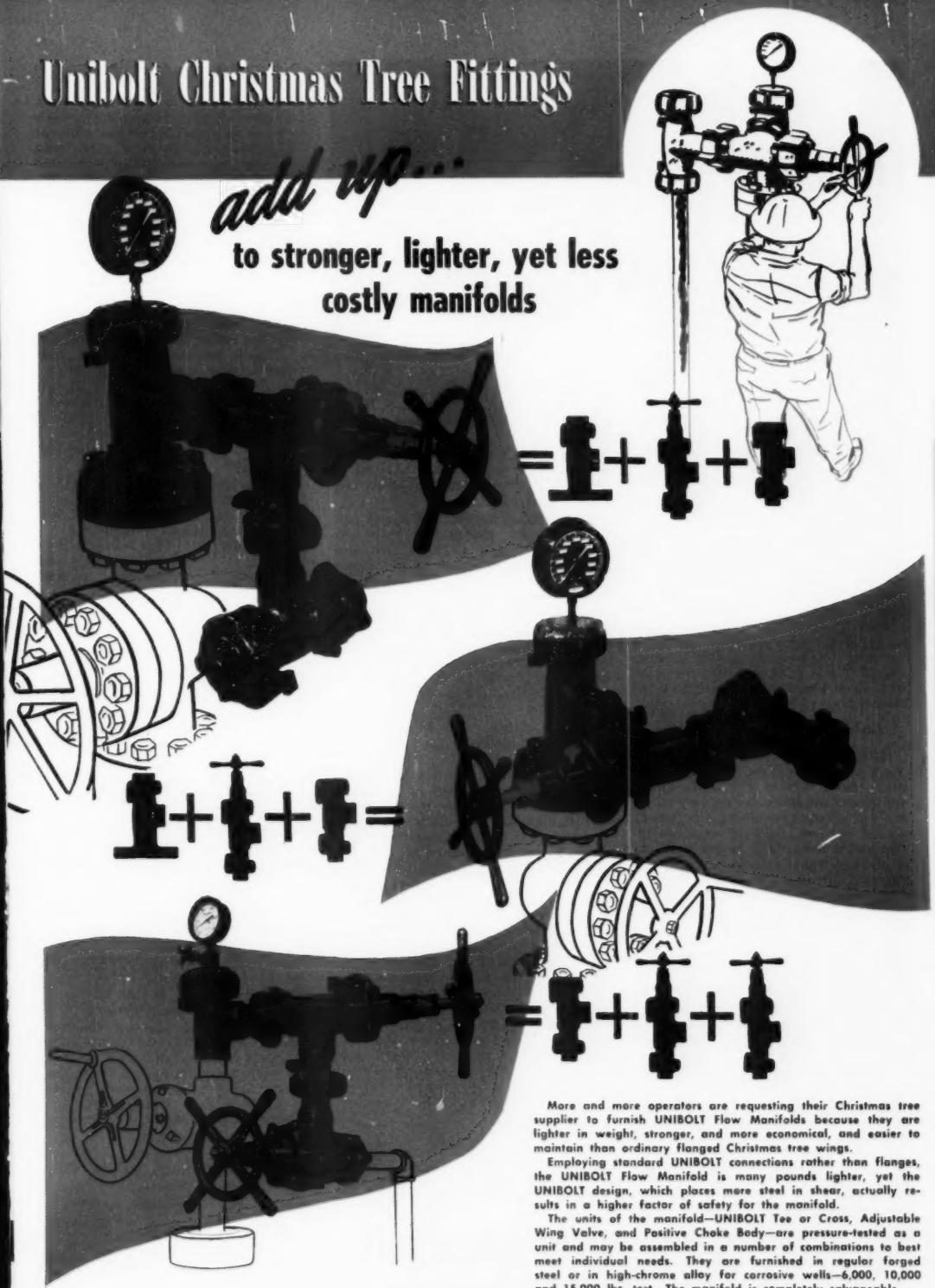


Fig. 5—Refinery separator of the Dorr design skims off oil continuously. Sludge removal from bottoms also continues.

Unibolt Christmas Tree Fittings

add up...

to stronger, lighter, yet less costly manifolds



More and more operators are requesting their Christmas tree supplier to furnish UNIBOLT Flow Manifolds because they are lighter in weight, stronger, and more economical, and easier to maintain than ordinary flanged Christmas tree wings.

Employing standard UNIBOLT connections rather than flanges, the UNIBOLT Flow Manifold is many pounds lighter, yet the UNIBOLT design, which places more steel in shear, actually results in a higher factor of safety for the manifold.

The units of the manifold—UNIBOLT Tee or Cross, Adjustable Wing Valve, and Positive Choke Body—are pressure-tested as a unit and may be assembled in a number of combinations to best meet individual needs. They are furnished in regular forged steel or in high-chrome alloy for corrosive wells—6,000, 10,000 and 15,000 lbs. test. The manifold is completely salvageable.

THORNHILL-CRAVER COMPANY • P. O. BOX 1184 • HOUSTON, TEXAS

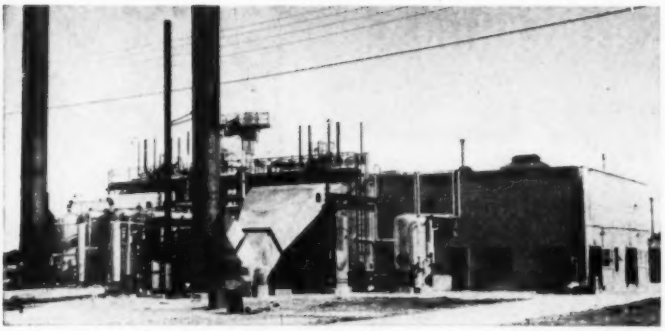


Fig. 6—Utility plant centers around two 50,000-lb. per hour boilers located outside firing fronts in utility building.

erly direction through the process units to base stock storage, then to product-blending tankage. Finally, the finished products are pumped either north to the loading rack or west through a metering station to the marketing truck loading area.

The utility plant has been located north of the process area to minimize piping. The refinery fire-protection system depends on an air-foam truck, and, in order that this truck may have access to the tank lots at all seasons of the year, certain tank fire walls have been designed to serve as elevated roadways. Even with a heavy snowfall it is expected that the wind will blow the bulk of the snow off the roadways.

Office and Technical Building

Refinery office building and the technical building are of frame-and-stucco construction. The latter building houses the laboratories, operations analysis group, processing supervisory personnel, and medical department. The maintenance and locker building is of steel-frame construction with a flat roof, and the walls are fabricated with Steelox-type panels. The process buildings and utility plant are of concrete-block construction with a flat slab roof.

Imperial's Winnipeg refinery has been designed to produce a complete range of motor fuels, diesel fuels, heating oils, heavy fuel oils, and certain types of asphalts. The major components of the processing equipment are as follows:

Atmospheric and vacuum unit.—The design of this unit was prepared by the engineering division, Imperial Oil, Ltd. Flow through the unit is shown by the simplified diagram, Fig. 1.

Crude oil is charged to the unit and preheated by progressive heat exchange with heavy naphtha, light gas oil, heavy gas oil, and atmospheric pumparound reflux before entering a Petreco desalting unit.

After leaving the desalting unit, the crude passes through further heat exchange with the vacuum pumparound reflux and vacuum pitch before entering the crude heater, whence it proceeds to the flash zone of the crude fractionator.

Light naphtha vapor from the top of the fractionator is condensed and flows to the distillate drum where water is continuously removed. From the top of this drum gas passes through the compressor system. The light straightrun naphtha is stabilized. The stabilizer uses circulated hot gas oil as a heating medium for the reboiler. Gas from the stabilizer combines with the gas discharged from the crude gas compressor and goes to the refinery fuel-gas system.

The stabilized light naphtha is combined with the heavy naphtha side stream and transferred to the treating plant. The heavy naphtha side stream is withdrawn from the seventh tray of the fractionator and is stripped in its own stripper. Light-gas-oil side stream is withdrawn from the fifteenth tray and stripped. Heavy gas oil is withdrawn from the twenty-fourth tray and is also stripped.

Reduced crude is transferred from the bottom of the fractionator through the vacuum heater to the flash zone of the vacuum flash tower. Overhead from this tower is partially condensed and passed to the overhead accumulator drum. The uncondensed vapor passes through the vacuum producing equipment which consists of a surface condenser and two stages of steam-jet ejectors, with a surface-type intercondenser.

Condensate from the vacuum equipment is pumped to the vacuum condensate drum where water is drawn off to the sewer and the oil recovered to slop-oil storage. A gas-oil side stream is withdrawn from a pan located below the fourth plate of the tower. The overhead and the side-stream gas-oil streams are combined and pumped to an accumulator from which the cracking-plant feed pumps take suction.

Pitch is pumped from the bottom of the tower and is fluxed with catalytic cycle gas oil to produce bunker fuel oil. Both crude and vacuum heaters are Petro Chem-type furnaces possessing heat to oil duties of 30.6 and 12.2 million B.t.u. per hour respectively.

Catalytic cracking and gas-concentration unit.—This unit can be divided into three sections and is illustrated in the simplified flow diagram, Fig. 2. It will be noted that the reactor is superimposed on the regenerator. The reactor is fitted with an external catalyst stripper and contains one main grid and two distribution grids.

Central treating plant.—Process design and specifications for this facility were prepared by Imperial's engineering division. This unit consists of four separate systems, Fig. 3.

The natural naphtha system is designed to treat naphtha from Redwater crude to produce a product of satisfactory quality. Regeneration has been provided to handle spent lye from both natural and cracked naphthas. A sand filter is included for the removal of moisture.

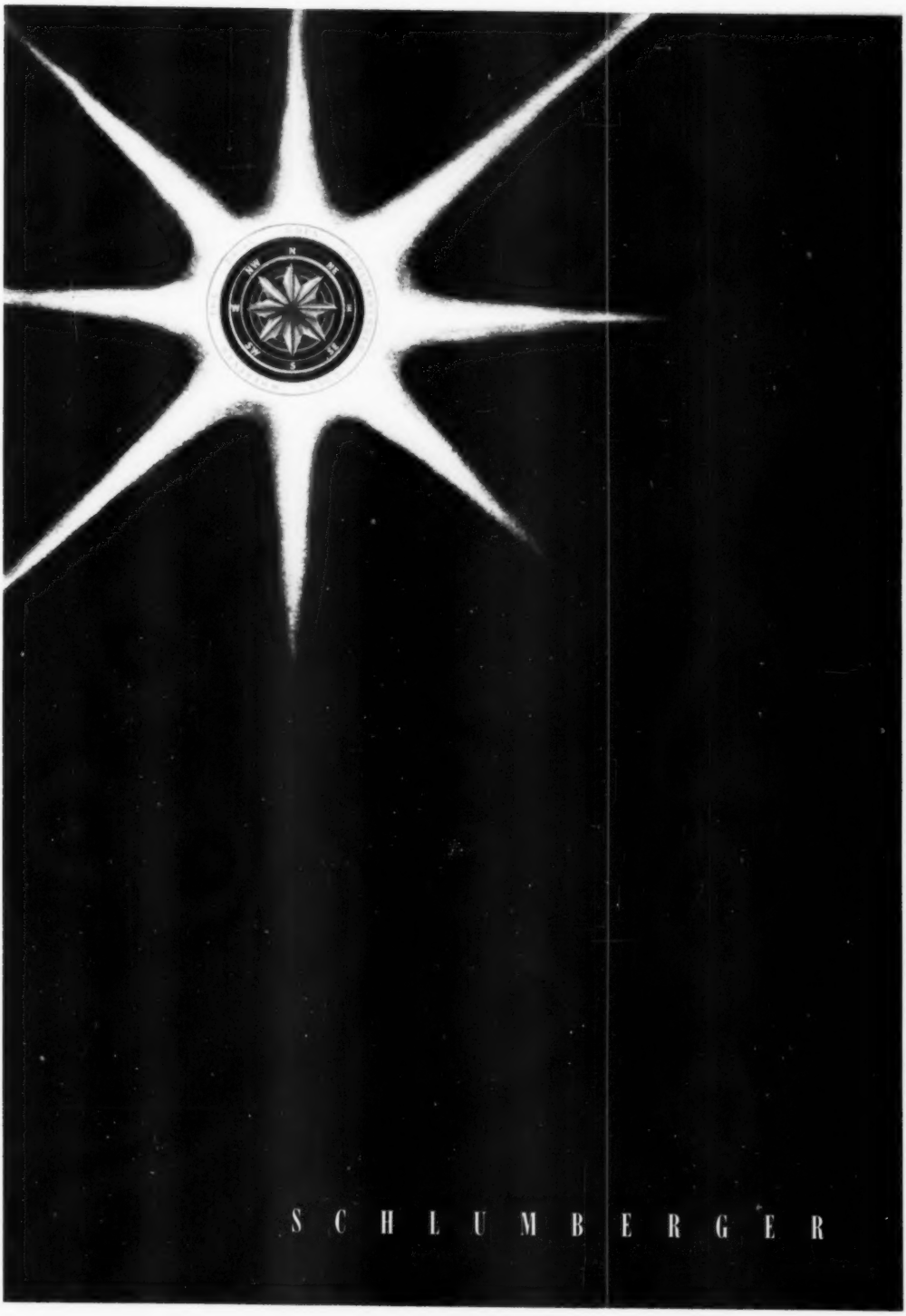
Cracked naphtha is treated in a two-stage caustic wash system. The first noncirculating system is designed to pick up organic acid compounds with weak caustic, while the second stage with recirculation up to 30 per cent removes mercaptans and residual acidity with a strong caustic solution. A sand filter is included for the removal of entrained caustic.

Cracked gas oil is treated in a conventional single-stage caustic-wash system followed by sand filtering.

Natural gas oil receives no chemical treatment, but is dried by sand filtering and rock-salt percolation.

Fresh caustic is received in drums as solid NaOH. It is made up into solution in the caustic melt tank from

Fig. 7—Maintenance and locker building features utility and attractive design.


SCHLUMBERGER

FRONTIER CHEMICAL COMPANY

always handy . . . sometimes indispensable

F.C.C. TANK CARS

As a service to customers, Frontier maintains its own fleet of tank cars. It is a convenient and often essential supplement to the common-carrier or for-hire tank cars that are not always available when needed. And even to customers who operate their own tank car fleets, our Frontier-controlled equipment often proves convenient — in emergencies, indispensable.

Control of its rail transportation units is one more step in Frontier's service to you — a service that has never let any regular customer down, even under shortage or emergency conditions. Frontier can meet your needs for Prime Quality heavy chemicals — caustic soda (liquid, flake or solid), muriatic acid, chlorine, oil well and industrial salt. Contract with Frontier — your dependable source of Supply, anywhere in the Mid-Continent, Rocky Mountain or Southwestern areas.

GEARED TO SERVE THE OIL INDUSTRY

MANUFACTURERS OF

caustic soda
(FLAKE, SOLID AND LIQUID)

muriatic acid

chlorine

oil well and industrial salt

Motor Transport service direct to points not served by rail

FRONTIER CHEMICAL COMPANY

• DELIVERIES WHEN AND WHERE YOU NEED THEM VIA MOTOR TRANSPORT OR TANK CAR

GENERAL OFFICES:
321 WEST DOUGLAS

PHONE 7-5215
WICHITA, KANSAS

ELECTRO-CHEMICAL
Frontier Chemical Company
MANUFACTURERS

Wichita, Kansas • Denver City, Texas • Midland, Texas • Denver, Colorado

which it can be pumped to storage tanks. From these tanks it can be pumped to any of the treating systems. Tankage is also available for the storage of spent caustic.

A spent-caustic disposal unit is also provided. In this unit spent caustic is neutralized by flue gas from the cat cracker in a small packed tower. The liquid effluent from this tower contains mainly carbonates and bicarbonates, and is discharged to sewer. The foul flue gas is burned in a furnace.

Common control room.—All processing units at Winnipeg are served by this facility. The control room is fitted with a modified brown color graphic panel. The panel provides all the regular records of process variables through the use of conventional instruments with multirecording pens. In addition, the flow-pan section of the panel contains indicators of critical process variables and gives a ready and complete picture of current operation. A photograph of a section of the panel is shown in Fig. 4.

Offside Facilities

Winnipeg refinery supplies a market which has extreme seasonal fluctuations of product demand. Tankage was installed taking these fluctuations for each product into account and amounts to slightly over 1,000,000 bbl. Products are shipped direct from refinery storage for finished products to either tank cars or tank wagons.

The refinery separator is a circular unit of Dorr design equipped with continuous top skimming for oil removal and bottom skimming for sludge removal (see Fig. 5). Skimmed oil runs to a covered sump tank and is pumped periodically to a storage tank which accumulates and settles the oil and emulsion picked up from the surface of the separator. Emulsions are broken by transferring them to an elevated cone bottom tank for chemical treatment. Sediment from the bottom of the separator is also continuously accumulated in a built-in sump. This is pumped out at intervals and the sediment removed to a disposal pit.

Unit Separator

A unit separator is located at the refinery units to trap oil originating there. By this installation, a substantial portion of the oil is removed before it has had an opportunity to become seriously emulsified. This is recharged to the crude unit without treatment other than water settling.

The unit separator discharges to the regular sewer system which goes to the main refinery separator. The only chemical used in quantity for treating is caustic soda which becomes spent and must be discarded.

Discharge from the refinery separator is limited to an innocuous stream containing no substances detrimental to aquatic life. Efficiency of this type

For
RIGGING UP EQUIPMENT . . .
Setting Boilers
Slush Pumps,
Compressors,
Diesel and Gas Engines.
. . . .
Tightening Belts—
Lifting and Lowering Pipe,
Large Valves, Etc.
Use Dependable

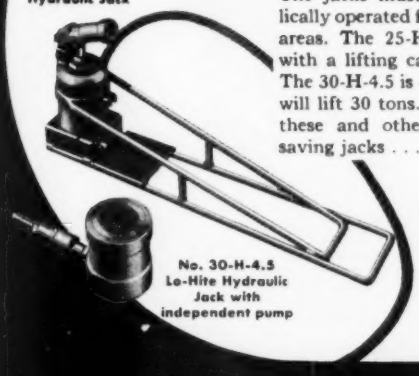
DUFF-NORTON
JACKS

Big jacks . . . small jacks . . . jacks with lifting capacities ranging from 3 to 100 tons . . . all are available from the Duff-Norton complete line of jacks for every lifting and lowering requirement in the oil industry.

No. 25-H-9.3
Hydraulic Jack

The jacks illustrated are hydraulically operated for use in low height areas. The 25-H-9.3 is 9⅜" high with a lifting capacity of 25 tons. The 30-H-4.5 is only 4½" high and will lift 30 tons. For more data on these and other time and effort saving jacks . . .

WRITE FOR HYDRAULIC JACK BULLETIN AD-16-U



No. 30-H-4.5
Lo-Hite Hydraulic
Jack with
independent pump

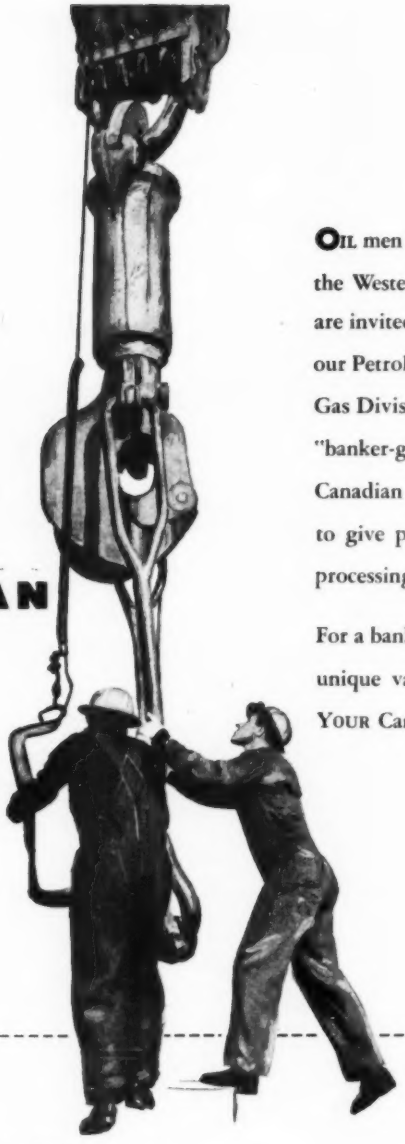
STRENGTH, SAFETY, DURABILITY
DUFF-NORTON JACKS
ESTABLISHED 1883

THE DUFF-NORTON MANUFACTURING CO.
MAIN PLANT and GENERAL OFFICES, PITTSBURGH 30, PA.—CANADIAN PLANT, TORONTO 6, ONT.
"The House that Jacks Built"

KNOW

CANADIAN

OIL!



OIL men interested in the Western Canadian oil fields are invited to consult with our Petroleum and Natural Gas Division at Calgary. Its "banker-geologist" team knows Canadian oil . . . and knows how to give practical help in processing oil financing plans.

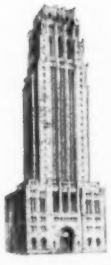
For a banking relationship of unique value, make us YOUR Canadian bank.

Write for This Booklet!

"For Oil and Allied Industries" contains factual information on Canadian exchange control regulations; taxes; leases and reservations; customs regulations; a map of the oil and gas fields, and other important data.

Direct inquiries to:
Petroleum and Natural Gas Division
The Canadian Bank of Commerce
Calgary, Alberta, Canada

The Canadian Bank of Commerce



HEAD OFFICE: TORONTO

New York San Francisco Los Angeles Portland, Ore. Seattle

600 Branches across Canada

of separator also reduces the oil content of the effluent water to trace quantities. At the present time the effluent is limited by a ruling of a provincial commission to not more than 15 p.p.m. The refinery has been successful in meeting this limitation.

Utility Plant

Specifications for the utility plant were prepared by Imperial's engineering division. This plant includes two 50,000-lb. per hour boilers, which are built outside with firing fronts located inside the utility building (Fig. 6). This building also houses the boiler feed pumps, the plant air compressors, the instrument air compressor, air dryers, the domestic water well and pump, cooling-water circulating pumps, and the fire pump.

The main electrical substation and the boiler feed water treating equipment are located adjacent to the building. Utilities for the refinery, except river-water pumping, are located in one area under the control of the utility-plant personnel. The water-cooling tower is a Fluor two-cell unit and is located east of the utility plant. Treated water is currently used as cooling tower makeup.

Low-Cost Power Available

The refinery is located in an area where reliable and low-cost electric power is readily available. It was decided to provide the refinery with a maximum motor drive and a minimum turbine drive, since about 90 per cent of the power is consumed by drives for the pumps and compressors. The steam-generating plant is designed to be unaffected by power failure. Essential pumps will start up on turbine drive automatically when a power failure occurs.

Two 24,000-volt feeders supply the refinery through two 3,000-kva. transformers. For the present the lines are not operated in parallel; but they can be if future demands are increased. The high voltage (4,160 volts) power is distributed from the main substation to three smaller 750-kva. unit substations by means of two loop circuits operated as radial feeders. Motors 150 hp. and larger operate on 4,160 volts. Motors below 150 hp. operate on 440 volts and fractional horsepower motors operate on either 110 or 220 volts.

A 1,000-hp. synchronous motor drives the centrifugal air compressor at the fluid catalytic cracking unit. The motor is started across the line, the inrush current being 550 per cent of full load current, while the resulting voltage drop is approximately 12 per cent. Low capital investment was the chief factor in selecting this type of drive.

The maintenance and locker building (Fig. 7) contains centralized storehouse, garage, machine shop, and welding-shop facilities, as well as lunch, locker, and wash rooms for employes.

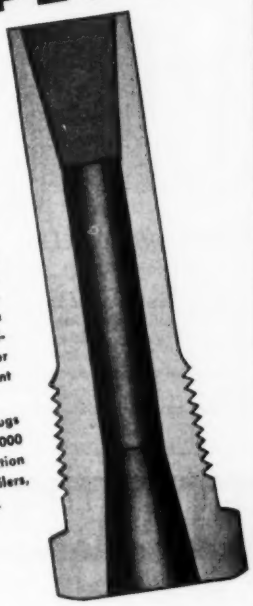
BOILER SAFETY!

WECO FUSIBLE PLUGS

• Weco Fusible Plugs meet revised A.S.M.E. requirements and are made in strict accordance with the requirements of the Power Boiler Code Committee. They are acceptable to all Boiler Inspection Authorities working under A.S.M.E. codes.

The ¾"x4" Fusible Plug provides additional protection. It will melt out at approximately 450 deg. F. When it melts-out it leaves approximately 9/16" of water over the crown sheet to prevent damage.

All Weco Fusible Plugs are kerosene tested to 1000 lbs. pressure. For protection and safety of your boilers, use Weco Fusible Plugs.



WECO FUSIBLE PLUGS

SIZE	NO.	WEIGHT
½" x 2¼"	1093	5 oz.
½" x 2¾"	1087	6 oz.
½" x 3½"	1081	8 oz.
¾" x 2¼"	1091	8 oz.
¾" x 3"	1085	10 oz.
¾" x 3" Lg. Thd.*	1097	10 oz.
¾" x 4"	1079	12 oz.
¾" x 4" Lg. Thd.*	1095	12 oz.
1" x 2-5/16"	1089	12 oz.
1" x 3"	1083	12 oz.
1" x 4"	1077	16 oz.
*1¼" Thread length		

SOLD EXCLUSIVELY THROUGH SUPPLY STORES

It's Wise to Standardize with... WECO ...

WELL EQUIPMENT MFG. CORP.

A Subsidiary of Chiksan Company

HOUSTON 1, TEXAS

Exclusive Sales Representative Outside Mid-Continent Area

CHIKSAN COMPANY

Brea, Calif. · Chicago 3, Ill. · Newark 2, N. J.

Export Sales: CHIKSAN EXPORT COMPANY, Brea, Calif. · Newark 2, N. J.

Manufacturers and Distributors of Oilfield, Refining, Marine and Industrial Equipment

NOT THAT ONE CURLEY... IT DOESN'T HAVE TO BE DUMPED AND REFILLED EACH YEAR!

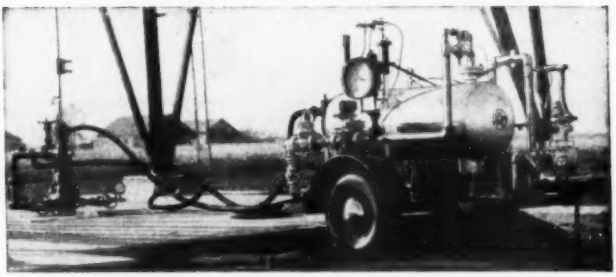
Maintenance costs for Ansul Dry Chemical Fire Extinguishers are negligible. No annual recharge is necessary. Ansul *"PLUS-FIFTY"* Dry Chemical maintains its superior fire-killing characteristics indefinitely . . . and factory-filled Ansul gas pressure cartridges are guaranteed against leakage.

Ansul Extinguishers are your best protection for flammable liquid, gas and electrical fires. They save you money two ways . . . lower fire losses (including lost production time) . . . and lower maintenance costs.

SEE PAGE 268

ROLO WELLCHECKERS

SKID AND TRAILER MOUNTED OIL AND GAS SEPARATORS



Field installation of trailer-mounted Rolo Wellchecker No. 1H-2406

Made in various sizes to fit any operation, Rolo Wellcheckers are shipped completely piped and ready to operate. You need only connect inlet and outlet. In addition to oil meter, B. S. & W. sampler, gas run, orifice meter, fittings and all controls, free water knockout with meter can be furnished to separate and continuously remove free water from well fluid. See Composite Catalog or write for illustrated Bulletin 1951-W.

Crude Oil Metering Specialists

ROLO MANUFACTURING COMPANY

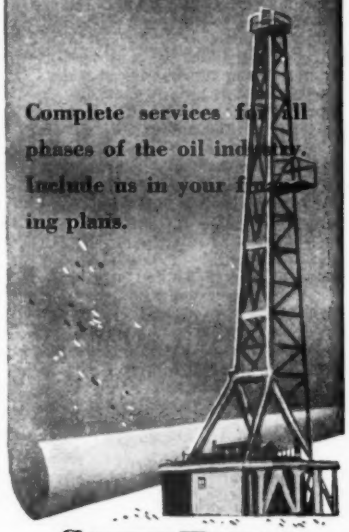
2510 South Blvd., Houston 6, Texas

BRANCHES: Corpus Christi, Midland, Kilgore, Tulsa, New Orleans, Los Angeles, Casper, Calgary (Alta.)
EXPORT OFFICE: R. S. Stokvis & Sons, Inc., 17 Battery Place, New York, N. Y.

SOUTH TEXAS NATIONAL BANK OF HOUSTON

Oil Production Loans

Complete services for all phases of the oil industry. Include us in your financing plans.



SOUTH TEXAS NATIONAL BANK

213 MAIN STREET • HOUSTON, TEXAS

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

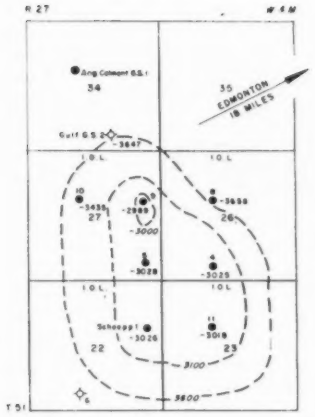


Fig. 1—Map of Golden Spike, Alberta, field.

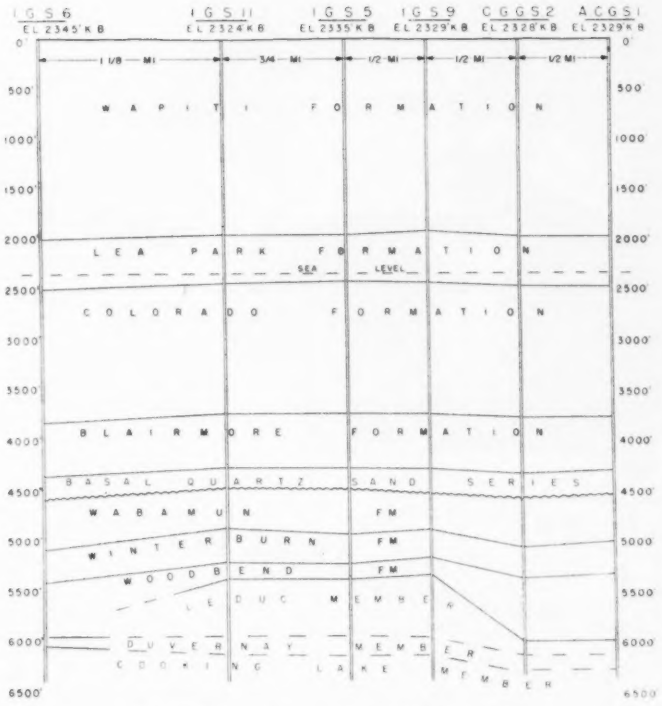


Fig. 2—North-south cross-section, Golden Spike area.

Analysis of Canada's Golden Spike Reservoir

by I. Haskett*

Here's what can be expected of Canada's spectacular oil field with its 230,000,000 reservoir barrels of oil under only 1,600 productive acres

GOLDEN SPIKE pool, discovered by Imperial Oil, Ltd., in April 1949, produces from a Devonian limestone reef having a maximum thickness of over 600 ft. Although the productive area is estimated at only 1,500 to 1,600 acres, the oil in place is about 230,000,000 bbl., making the pool one of the major oil reserves in Alberta.

The producing characteristics of the pool make it an extremely interesting one from the standpoint of reservoir engineering. Structural conditions are favorable to gravity segregation, and other reservoir characteristics are such that a comparatively high recovery efficiency should be obtained for almost any method of exploitation which might be considered. It is, therefore, a pool where the problem is not merely to determine an efficient manner in which to produce the reservoir, but where several possible efficient methods will have to be compared on their relative merits.

At a time when only about 0.3 per cent of the estimated oil in place has been produced, a large amount of information about the reservoir has been obtained. The homogeneity of the main portion of the pool has made it possible, from the core data obtained, to evaluate the porosity and permeability characteristics and distribution for the entire reservoir more completely than has yet been possible for any of the other Devonian reef limestone reservoirs.

With the cooperation of the Alberta Petroleum and Natural Gas Conservation Board, it has been possible for the operator to carry out field tests of much greater scope than is usual, including a complete shutdown of the field for 2 months in order to evaluate a possible water drive. In addition, productivity and interference tests have been made in which one well has been produced for several days at a higher rate than the total field production had ever before reached.

*Reservoir engineer, Imperial Oil, Ltd., Calgary, Alta.

History of Development

Golden Spike pool, located 18 miles southwest of the city of Edmonton, Alta., was discovered by Imperial 1 Schoepp well, in LSD 9, 22-51-27w4. This well contacted top of the porous D-3 formation at 5,362 ft., or 3,026 ft. subsea. Seven-inch casing was set to the top of the zone, and continuous coring and testing was carried on through 545 ft. of porous productive formation and 175 ft. of dense material to a total depth of 6,082 ft. The well was plugged back to 5,956 ft. and completed open hole, without acid treatment, on April 18, 1949. Initial

A STATEMENT by . . .

JOHN H. WILSON

PRESIDENT and CHIEF ENGINEER

WILSON MANUFACTURING CO., INC.

TO THE

DRILLING INDUSTRY

THIS NEW Wilson ATLAS RIG is the WORLD'S FINEST!

I would like for everyone in the Drilling Industry to see the NEW Wilson Rigs, study them and compare them with any other make of rig.

In the past few years we have completely redesigned our entire line of drilling rigs, from the console control and Air-Tube clutch drum in front to the new sectional plate type compound in the rear, THESE RIGS ARE ALL NEW!

These New Rigs are as far ahead of our older type rigs, or any other make of rigs, as our power rigs were ahead of steam in years gone by. You wouldn't compare a Cadillac of ten years ago with a modern car of any other make. And by the same token it isn't reasonable to compare a Wilson Rig of five or ten years ago with a late model rig of another make. Any comparison of these NEW rigs with our rigs of five or ten years ago, or any other rigs of today will open your eyes to the many outstanding improvements and exclusive advantages of the Wilson line.

We have now completed all the design changes which we know of at this time, and have standardized on these new models. We contemplate no further alterations. And all these new designs have now been proved superlatively good by more than two years of field experience, with almost no trouble, on more than one hundred rigs!

All these new rigs have been designed so they can be used either with or without torque converters, and with equally satisfactory results. *All multiple engine rigs are designed alike*, and all have the best features found in any drilling rig, and many more found only in Wilson rigs!

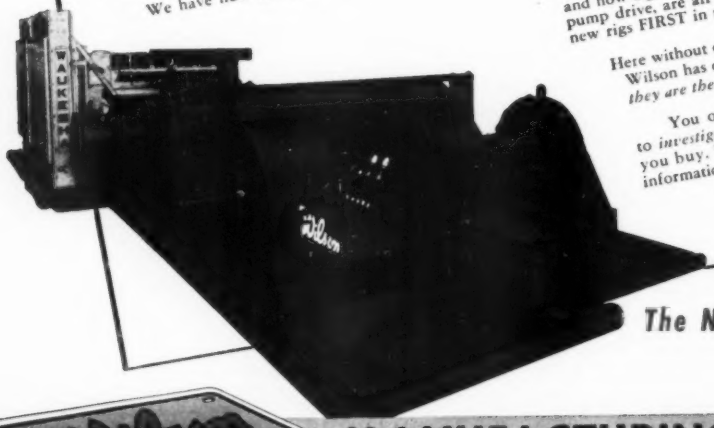
Customer after customer has reported these new rigs are the finest, most trouble free, most dependable rigs they have ever used.

With a rig for every depth, from "grass roots" to the deepest well that can be drilled, Wilson can take care of any rotary drilling rig requirement.

The two speed Air-Tube disc clutch drum, the two speed all friction clutch transmission, the sectional plate type compound, the direct rigid connection of engines to compound, the full vision console control, and now eight drum speeds, and two speed air clutch pump drive, are all Wilson Firsts that place these new rigs FIRST in the field of rotary drilling rigs.

Here without question are the finest Drilling Rigs Wilson has ever built; and we sincerely believe *they are the best rigs built today by any maker!*

You owe it to yourself or your company to *investigate* these new Wilson Rigs before you buy. Write, wire or phone for complete information *today!*



The New WILSON ATLAS RIG

Wilson

MANUFACTURING CO., Inc.

WICHITA FALLS, TEXAS

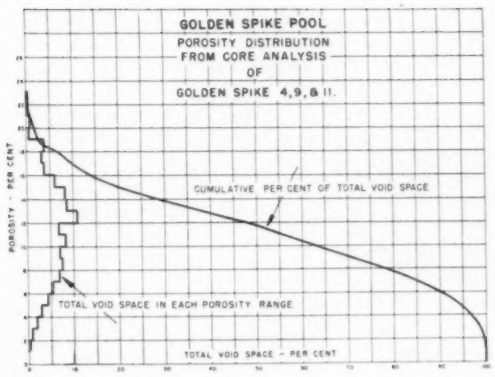

GOLDEN SPIKE POOL
POROSITY DISTRIBUTION
FROM CORE ANALYSIS
OF
GOLDEN SPIKE 4,9,8 11.
POROSITY - PER CENT
CUMULATIVE PER CENT OF TOTAL VOID SPACE
TOTAL VOID SPACE IN EACH POROSITY RANGE
TOTAL VOID SPACE - PER CENT

Fig. 3.

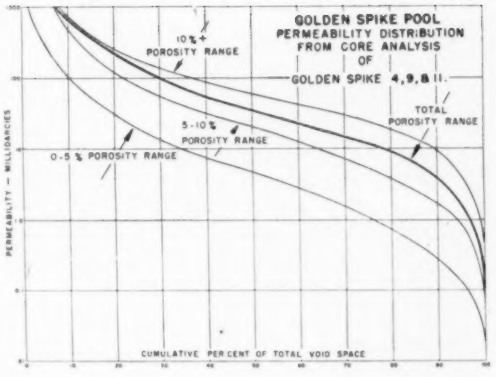


Fig. 4.

potential on open-flow test was 7,320 bbl. per day of 36° A.P.I. gravity oil, with an estimated gas-oil ratio of 500 cu. ft. per barrel.

Development.—Although well locations are in the center of 40-acre tracts, development has thus far been limited to one well per quarter section, uniformly spaced. Up to the present time seven producers have been completed, all with the entire section open and without acidization. Dry holes and structurally low wells have indicated the approximate productive limits except to the southeast. The well locations and estimated top of porosity contours are shown in Fig. 1.

Geology

Production in Golden Spike pool is from the Leduc (D-3) member of the Woodbend formation of Upper Devonian age. The D-3 occurs here as a limestone reef column, outlying and apparently isolated from the dolomitic D-3 zone of thhe Leduc-Woodbend reef, although it is found only about 4 miles west of the North Woodbend area. A north-south stratigraphic cross-section is shown in Fig. 2. No production was obtained from the Gulf 2 Golden Spike well, and it is believed that the producing zone in the 1 Anglo-Calmont well is not continuous with the main structure.

Six of the wells have found thick producing sections, with no water being encountered. The productive zone is limited at the bottom by a zone of dense limestone having essentially no porosity and no permeability. This zone separates the D-3 from the water-bearing fragmental limestone, or Cooking Lake member of the Woodbend formation, and is approximately 100 to 200 ft. thick.

The 8 Golden Spike, on the northeast corner of the field, is producing from a structurally low porous zone about 80 ft. thick, with the lower 60 ft. containing water. Thus, a possible connection between the reservoir and an aquifer is indicated. Declining production from this well, however, has recently provided evidence that

TABLE 1—PRODUCING INTERVALS

Well	Top of porosity, ft., subsea	Bottom of porosity, ft., subsea	Thickness of productive zone, ft.
1	3,026	3,571	545
4	3,025	3,585	560
5	3,028	3,591	563
8	3,658	3,736	*20
9	2,989	3,604	615
10	3,435	3,692	257
11	3,018	3,571	553

*Water-oil contact estimated at 3,678 ft. subsea.

TABLE 2—BASIC PRODUCTION DATA

Estimated productive area, acres	1,590
Total closure, ft.	703
Average oil-zone thickness, ft.	382
Stock-tank oil in place, bbl.	232,000,000
Connate water (est.), per cent	20
Shrinkage factor	0.77
Average porosity, per cent	8.0
Original reservoir pressure (—3,300 ft.), psig.	2,095
Saturation pressure, psig.	1,370
Reservoir temperature, °F.	150
Solution gas-oil ratio (flash liberation), cu. ft./S.T. barrel	503
Stock-tank-oil gravity, °A.P.I.	36

TABLE 3—CORE ANALYSIS DATA

Well	Porous section analyzed (ft.)	Footage effective K>1.0 md.	Per cent of section effective	Per cent porosity of Eff. section	Weighted average porosity of total zone
4	558	521	93.3	11.79	11.10
9	600	553.5	92.3	7.46	6.80
10	252	85.6	34.0	4.79	1.63
11	536	462	86.2	10.65	9.18
8 (Oil zone)	20	11.2	56.0	5.81	3.25

THE AUTHOR

Miss Irene Haskett is rapidly establishing herself as an outstanding production technologist of western Canada where she has been located since 1949. Previously she was connected for 5 years with the research and development laboratory of Carter Oil Co., Tulsa. She joined that organization after she graduated from University of Oklahoma as a physics major.

the producing section in this well is only poorly, if at all, connected with the main portion of the pool.

In Table I the depths of the top and bottom of porosity are given for the individual wells.

It has been assumed for reservoir work that the —3,600-ft. contour of the top of porosity can be considered the productive outline, the total area enclosed being 1,590 acres. Since accurate contours cannot be drawn of the bottom of the porosity, this depth has also been assumed to be the average lower limit of production.

Reservoir Characteristics

A summary of basic data for the Golden Spike pool is given in Table 2.

A summary of the porosity data for the five wells which have been cored and analyzed is given in Table 3.

The average porosity of the three cored wells having a full productive section is 9.0 per cent, and this value should be representative for the thick central portion of the pool. The core from the No. 10 well was characterized by interbedded dense streaks of up to 25 ft. in thickness, and lower porosities in the effective sections. If this is typical of the conditions around the periphery of the pool on the steep edges, the over-all pool average porosity would be lowered somewhat, and an average value of 8 per cent has been estimated.

The four types of porosity usually found in reef limestone material are present, with the void space being contained in vugs, intergranular material, fractures, and in the dense matrix. For the major portion of the field, a general classification was

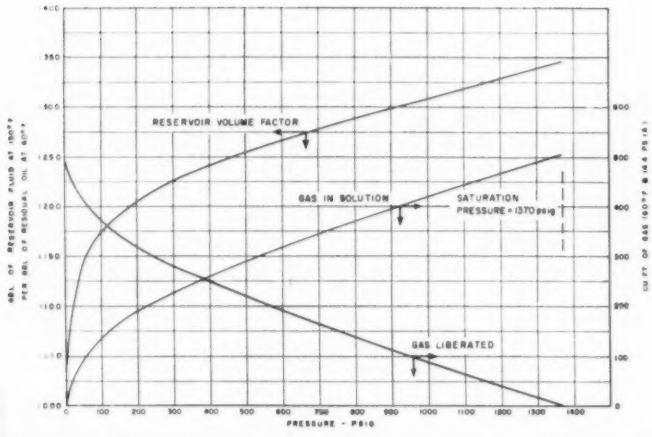


Fig. 5—Reservoir fluid characteristics, differential liberation at 150° F., of Golden Spike pool.

made of the relative amounts of void space in the different ranges and types of porosity.

Using all data from the analyses of almost 1,700 ft. of core from Wells No. 4, 9, and 11, the per cent of the total void space occurring in various porosity ranges, and the proportion of the total void space occurring in porosities greater than a given value, were plotted as shown in Fig. 3. It may be seen from this graph that while the over-all porosity variations are from 0 to 26 per cent, 90 per cent of the void space occurs in porosities of greater than 6 per cent, and 80 per cent of the total void space occurs in porosities of from 6 to 17 per cent. Since it is generally found that a core having a porosity greater than 10 per cent will consist primarily of intergranular material, it may be further inferred from this graph that at least 63 per cent of the total void space in the reservoir is contained in rock of this type, which may be fractured, but probably contains a few vugs and little dense material.

It may also be tentatively concluded that about 31 per cent of the total void space is contained in either less-porous intergranular material, a mixture of intergranular with dense or vuggy material, or dense matrix material with a large number of well-connected vugs, this type of combinations usually comprising the group of cores with porosities of from 5 to 10 per cent. The remaining 6 per cent of the void space is in material having porosities of less than 5 per cent, which is generally dense matrix material containing a limited number of vugs.

The permeability distribution indicated by core analysis is shown in Fig. 4, this graph again representing all data obtained on Wells No. 4, 9, and 11. The curves show the proportion of the void space contained in samples having either a vertical or horizontal permeability greater than any given value, both for the total core, and for each of the three porosity groups considered above. It can be seen that the higher porosities tend to have higher and more uniform permeabilities. The median values for the three groups, which probably has more meaning than numerically weighted values, are 4, 20, and 60 md. The median value for the total core considered is about 35 md.

These classifications are quite general, and do not approach the accuracy of a full-scale pore-size distribution study. However, it is felt that consideration of these porosity and permeability distribution curves will aid in selecting cores for laboratory tests of connate water, relative permeabilities, and recovery efficiencies by various production methods, as well as provide a means of weighting the results of the tests to obtain average figures for the entire reservoir.

Productivity.—The effective horizontal permeability of the formation is indicated from several productivity tests to be in the order of from 100 to 200 md., typically somewhat higher than indicated by core analysis. In August 1950, permission was obtained from the Alberta Petroleum and Natural Gas Conservation Board to shut in all but one of the wells in the field, and to produce this well at a high enough rate to obtain reliable information on pressure drawdowns and well interference. Consequently the whole field was shut in for 3 days, and the static reservoir pressure was determined to be 1,915 psig. The 5 Golden Spike was then opened and produced at a rate of 4,000 bbl. per day for 4 days, with all other wells remaining shut in. Bottom-hole pressures measured during this test are shown in Table 4.

The pressures shown in this indicate extremely good communication between the various wells, over and above that which can be explained by the average permeability of the greater part of the formation. This continuity must be due either to a network of cracks and fractures, or to streaks of extremely high-permeability material. As evidenced by the rapid buildups after the test, the greater portion of the oil in the reservoir was not reduced to the pressures indicated by the well measurements to exist in these more permeable sections.

(Continued on page 268)

TABLE 4—DRAWDOWN PRESSURES

(Pressures measured with No. 5 flowing at 4,000 bbl. per day. All other wells shut in.)

Well	1st Day	2nd Day	3rd Day	4th Day	Total drawdown by 4th day
1	1,897	1,872	1,858	1,808	107 psi.
4	1,900	1,858	1,880	1,866	55 psi.
5	1,817	1,806	1,786	1,752	163 psi.
9	1,905	1,892	1,870	1,864	51 psi.
10	1,899	1,884	1,860	1,818	97 psi.
11	1,902	1,892	1,884	1,860	55 psi.

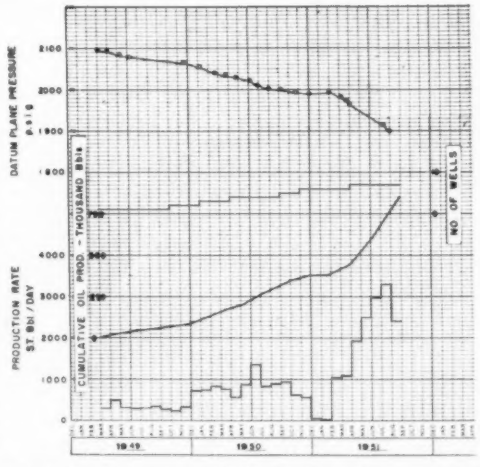
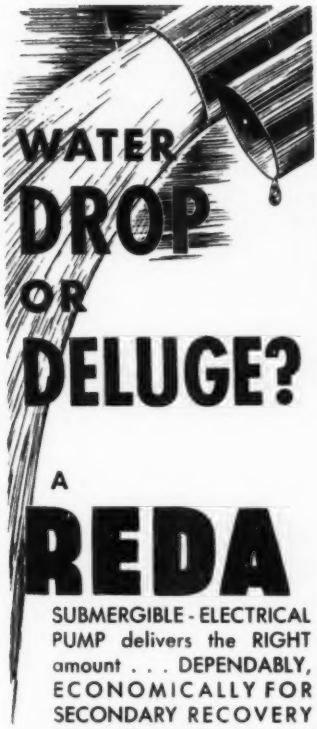


Fig. 6—Graphic summary of Golden Spike production and pressure statistics.



WATER DROP OR DELUGE?

A

REDA

SUBMERGIBLE - ELECTRICAL PUMP delivers the RIGHT amount . . . DEPENDABLY, ECONOMICALLY FOR SECONDARY RECOVERY from Pilot Stage to Full Flood . . .

ENGINEERING DESIGN

Reda Pumps produce the largest volumes obtainable from 5½", 7", 8⅝" casings, often reducing the required number of source wells. Corrosion resistance built into Reda Pumps materially prolongs time between pulling jobs, where corrosion is a factor.

ECONOMY

Reda Pumps reduce investment in number of supply wells required. Reda pumping equipment investment is less per barrel of daily capacity; pumping cost per barrel is lower.

FLEXIBILITY

To fit the changing needs for water volume as the flood progresses, Reda Pump can readily be altered or changed to larger or smaller sizes.

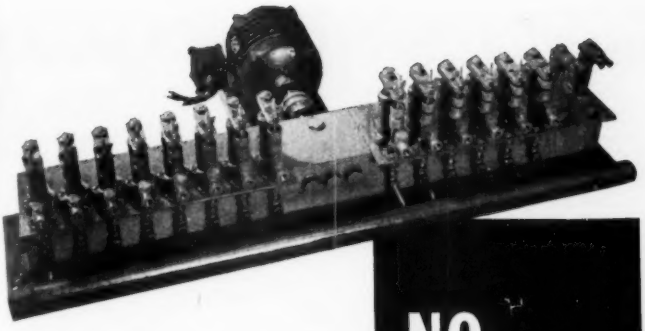
Reda Engineers have been closely associated with WATER FLOOD OPERATIONS for more than ten years and are fully qualified to assist operators in the selection of proper pumping equipment. A letter or phone call will bring prompt results.

REDA

PUMP COMPANY

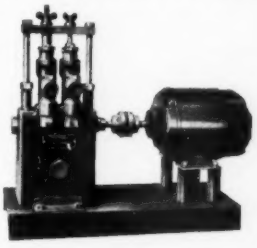
•

BARTLESVILLE, OKLAHOMA



MULTI-FEED CHEMICAL FEEDERS

Manzel flexibility permits *accurate* feeding of *many* different chemicals simultaneously. Chemicals can be pumped *into* other liquids or test samples drawn from production at regular intervals. Easily synchronized with any process. Supremely accurate proportional feeding. Any number of feeds, any type of drive.



LARGE OR SMALL CAPACITIES

Manzel Chemical Feeders pump from a fraction of a drop to 60 gph per feed...with *unsurpassed accuracy and dependability*. You eliminate troubles due to guesswork, inaccuracy, or forgetfulness.

Despite their time-tested dependability, Manzel Chemical Feeders are priced much lower than you might expect. They can be individually engineered for *any* application. Write for details today.

NO CHEMICAL FEEDING PROBLEM IS TOO DIFFICULT FOR

Manzel

336 Babcock St.
Buffalo 10, N. Y.

Specializing in High Pressure Metering Pumps since 1898

Activity in Western Canada . . .

. . . Soars to highest peak in dominion's history

EXPLORATORY and development operations in western Canada's oil industry are at the highest peak ever recorded in Canada's history. Since the beginning of 1951 there have been nearly 2 dozen oil discoveries, including 18 in Alberta, 2 in Saskatchewan, and 1 in each Manitoba and British Columbia. In addition to the oil strikes, natural-gas discoveries, primarily in Alberta, have been made at a rate of more than one per week.

The turning point in western Canada's oil-exploratory and development program came in 1947 with the discovery of the Devonian oil field at Leduc. Since that time, oil fields like Woodbend, Kavanagh, Golden Spike, Stettler, Joseph Lake, and others, became milestones in the progress of Canada's oil development. During the first years following the Leduc discovery in Alberta, the exploratory operations were confined primarily to that province, but soon followed to Saskatchewan, and have since broadened to Southwest Manitoba and Northeast British Columbia.

In early 1947 there were about 12 geophysical parties working in Alberta, and just under 2 dozen drilling rigs engaged. Exploratory and development activity increased at a steady rate since the Leduc discovery, with 150 geophysical crews currently exploring the Canadian West, and 215 drilling rigs actively engaged. According to statistical information on hand, 112 rotary rigs are working on field-development wells in Canada and 103 are wildcatting in search of new oil and gas fields. Of the total active rigs, 182 or about 85 per cent are operating in Alberta, 25 in Saskatchewan, and 4 in each Manitoba and British Columbia provinces.

Prime objective in western Canada's search is the Devonian coral reef that yielded major oil discoveries like Leduc-Woodbend and Redwater on the plains of Alberta. In terms of Devonian oil strikes this year, the active exploration companies have chalked up a substantial record so far in 1951. Prominent among the 1951 Devonian oil strikes are: Wizard Lake, a discovery about 5 miles southwest of Leduc where around 610 ft. of D3 oil-bearing reef has so far shown; Drumheller, about 65 miles

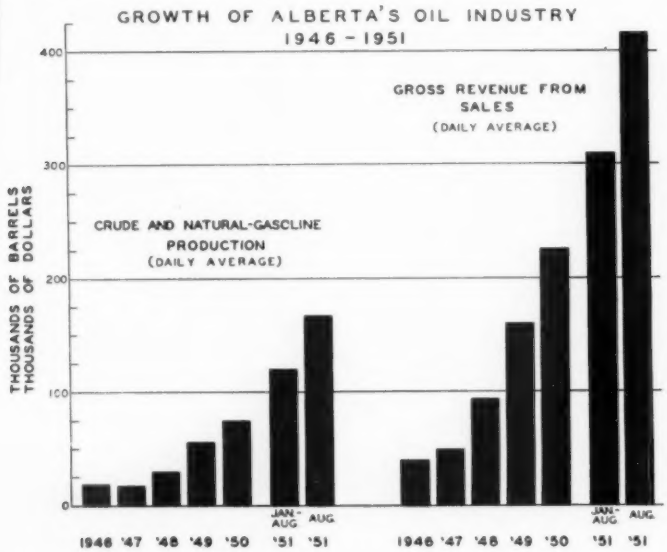
TABLE 1—ALBERTA OIL AND GAS INDUSTRY—1951 AND 1950
Compiled by the Alberta Petroleum and Natural Gas Conservation Board

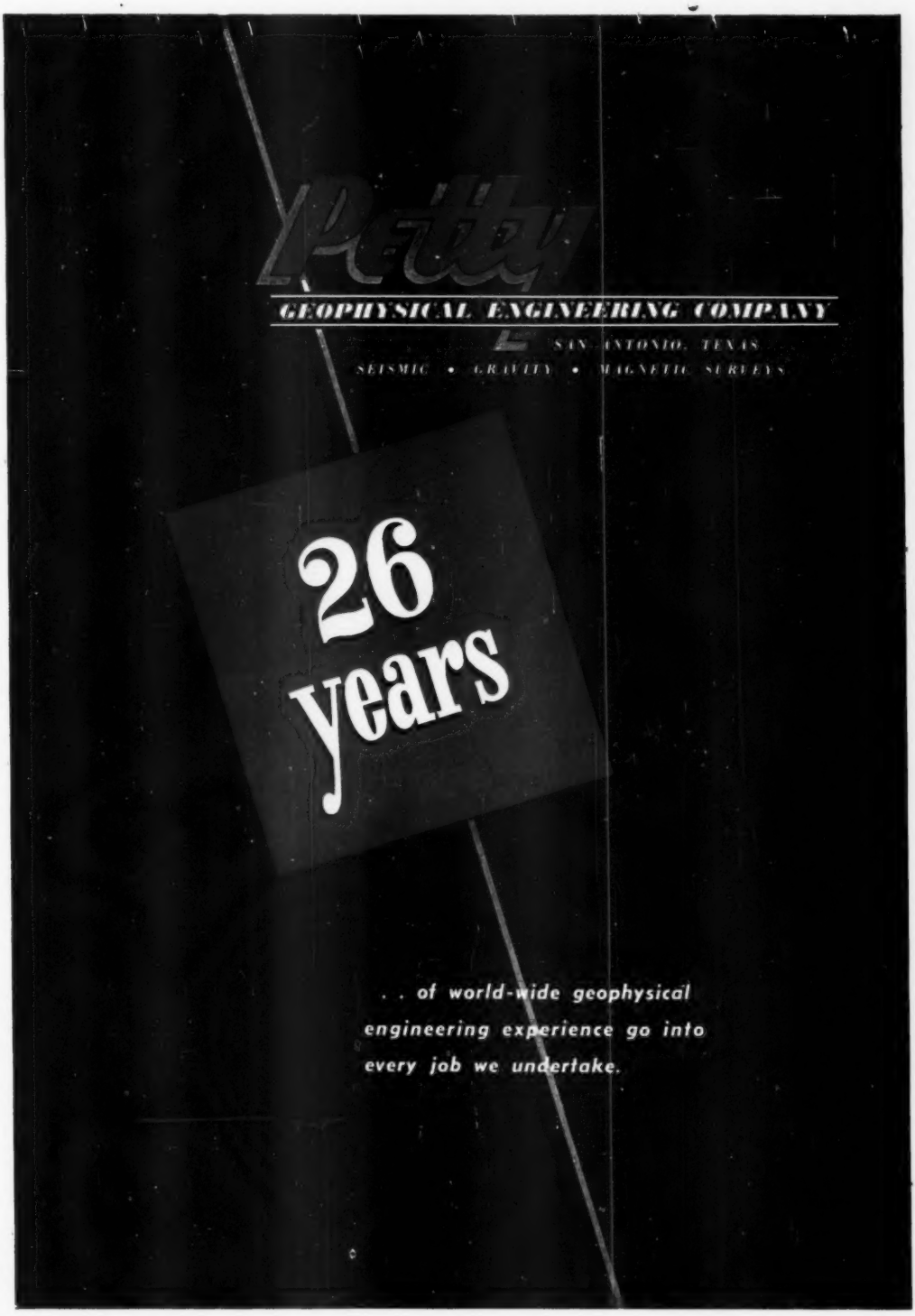
Comparative statement	8 months, 1950	8 months, 1951	Cumulative Sept. 1, 1951
Crude-oil production (barrels)	16,278,738	28,794,643	177,058,635
Natural-gasoline production (barrels)	287,300	302,288	7,984,774
Total production	16,566,038	29,096,931	185,043,409
Production—Daily average (barrels)	68,173	119,740	
Total revenue	$49,856,758	$75,717,783	$431,830,559
Revenue—daily average	$205,172	$311,596	
Natural-gas production (M.c.f.)	48,015,551	54,567,414	1,971,493,277
Footage drilled	2,660,583	3,502,538	19,999,206
New producers—oil wells	481	502	
New producers—gas wells	17	19	
Potential gas wells—capped	11	44	
Wells abandoned	148	215	
Rigs operating in August	103	134	

Disposition of crude oil (bbl.)	August 1951	8 months, 1950	8 months, 1951
Alberta refinery runs*	1,690,530	9,077,502	10,259,729
Delivered to Saskatchewan refineries	1,004,731	5,839,450	7,294,592
Delivered to Manitoba refineries	622,717	1,014,741	2,633,695
Delivered to Ontario refineries	1,925,294		7,747,726
Exports to Lakehead U. S. refineries	84,669		84,669
Inventories	145,902	299,293	1,142,979
Miscellaneous	28,568	47,752	73,204
Totals	5,210,607	16,278,738	29,436,594

*Alberta refinery runs include shipments of heavy crude from Saskatchewan oil areas (65,637 bbl in August 1951; 445,860 bbl. first 8 months of 1951).

Disposition of Natural Gas (in thousands of cubic feet)	August 1951	8 months, 1950	8 months, 1951
Sales of natural gas	2,887,881	31,977,733	35,987,572
Plant use	231,537	1,521,828	1,803,869
Field use	162,872	1,606,211	1,444,281
Stored gas (returned to formation)	466,864	1,582,230	2,016,348
Line fuel, loss and MD	137,346	39,609	200,759
Waste, etc	2,224,585	11,287,940	13,114,585
Totals	6,131,085	48,015,551	54,567,414




Petty
GEOPHYSICAL ENGINEERING COMPANY
SAN ANTONIO, TEXAS
SEISMIC • GRAVITY • MAGNETIC SURVEYS
26
years
. . of world-wide geophysical
engineering experience go into
every job we undertake.

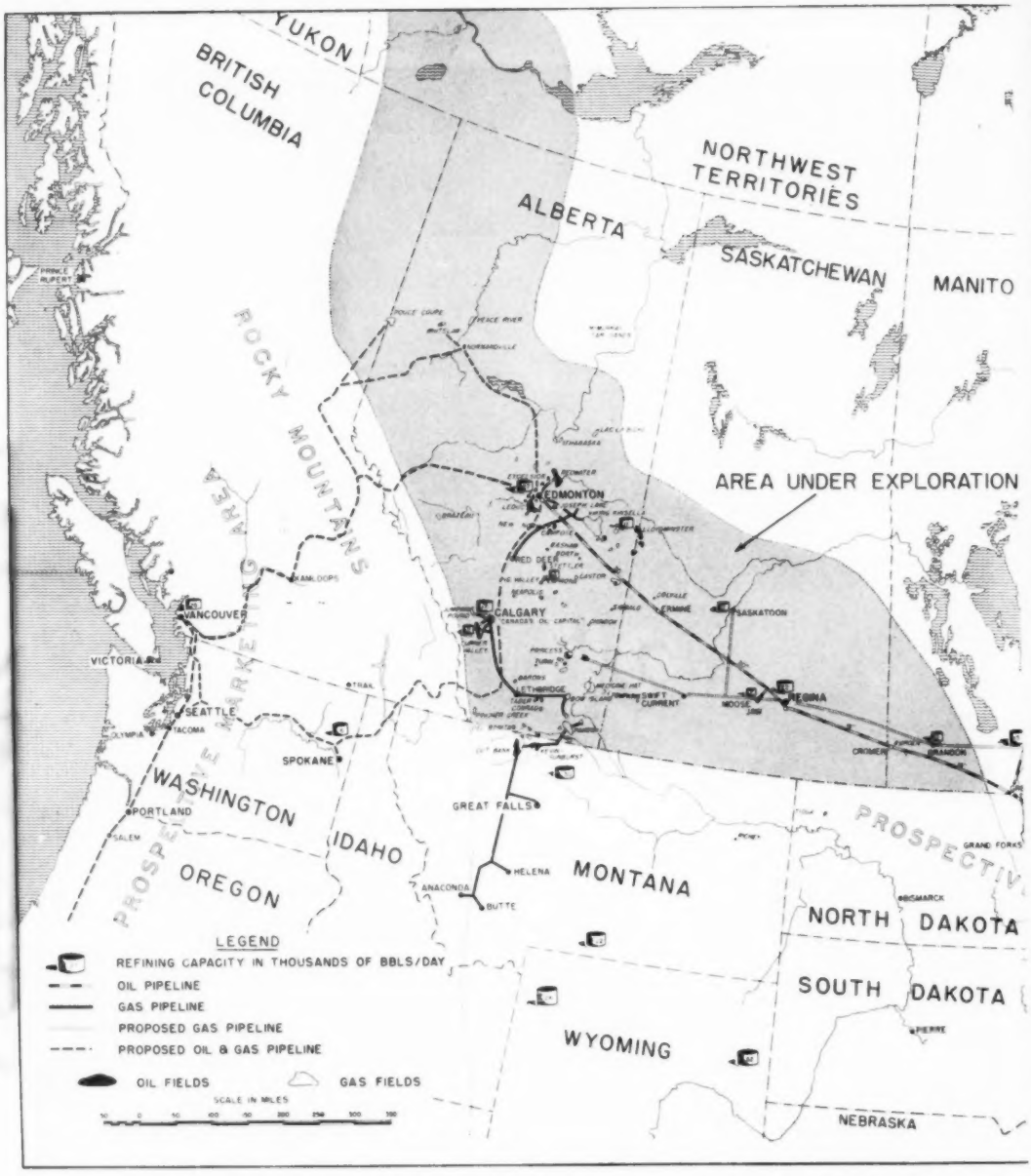


TABLE 1—PRINCIPAL ALBERTA FIELDS—1951 AND 1950

Production in barrels

Field—	Prod. 12 mo. of 1950	Prod. in Aug. 1951	No. of wells operating	Prod. 8 mo. of 1951	Cumulative oil yield
Redwater	10,746,472	2,856,051	868	15,098,190	30,675,028
Leduc-Woodbend	10,604,396	1,403,277	690	8,402,032	33,725,080
Turner Valley	3,775,369	272,202	265	2,262,500	108,194,239
Acheson-Stony Pl.	51,393	111,993	27	388,138	439,531
Excelsior	272,186	90,990	29	456,223	730,025
Golden Spike	292,873	105,511	9	403,845	781,799
Joseph Lake	168,855	71,924	58	412,138	616,851
Lloydminster (Alta.)	909,801	80,460	141	545,264	3,140,630
Total (principal fields)	26,449,159	4,992,408	2,088	27,968,130	178,303,183
Other fields	1,146,505	195,395	175	1,128,201	6,740,226
Total	27,595,664	5,187,803	2,263	29,096,931	185,043,409

Petroleum potentials of Canada cover vast area. (Map courtesy Nickel Map Service, Calgary.)

TABLE 3—WESTERN CANADA'S GEOPHYSICAL OPERATIONS (SEPTEMBER 1951)

Province:	Seismograph parties	Gravitymeter parties	Magnetometer parties	Total
Alberta	90	14		104
Saskatchewan	34	3	1	38
Manitoba	5	1	1	7
British Columbia	3			3
Western Canada Total	132	18	2	152

northeast of Calgary, where around 30 ft. of D2 Devonian oil-bearing zone has been encountered in a yet young field; Neapolis, a "wet gas" discovery some 35 miles north of Calgary, rated with a natural-gas potential between 50 and 70 million cubic feet daily and a distillate potential of around 700 bbl. daily.

Other Devonian oil discoveries made in Alberta during the initial 11 months of this year include Caprona-Fenn, New Norway, Clive, Bashaw, and Pine Lake. Numerous extensions and new pools have been made and discovered this year in Devonian oil fields such as Leduc-Woodbend, Stettler, and Big Valley. Additional wells in numerous other areas that showed some oil during drill-stem tests have added further encouragement to western Canada's explorers, and although they proved uncommercial they have given more incentive to their backers who will carry out additional operations in those regions.

The Devonian formation is not the only productive horizon that yielded oil discoveries during the first 11 months of 1951. Other Alberta strikes include the Viking-sand oil discovery in the Armena area of Central Alberta, the basal Cretaceous find at Alliance, the Permo-Pennsylvanian oil discovery in the Belloy area of Northwest Alberta, the Camrose area Viking oil discovery in Central Alberta, the discovery of crude oil in the basal Cretaceous at Ellerslie a few miles northeast of Leduc, and others.

The Canadian sector of the Williston-Moose Jaw basin is now being actively explored by geophysical

"THE MASTER OF FLAME"

FIRST..

in advanced engineering design and functional dependability . . .

FIRST..

in fire-stopping effectiveness with inexperienced operators . . .

MODEL 20-B

. . . . Your BEST PROTECTION FOR FLAMMABLE LIQUID, GAS AND ELECTRICAL FIRES

ANSUL
DRY CHEMICAL
FIRE EXTINGUISHING EQUIPMENT

Ansul Dry Chemical Fire Extinguishers were FIRST with the GREATEST FIRE-KILLING RATINGS ever attained by hand and wheeled portable fire extinguishers*. No type or make of extinguisher has ever exceeded Ansul's effectiveness ratings for flammable liquid fires.

Ansul features include: 1) Patented nozzle which provides the most effective stream pattern for quick extinguishment of fires . . . in addition to forming a heat-shield for the operator. 2) Water-tight and corrosion-resistant construction. 3) Easy, on-the-spot recharging after use without special tools . . . and many others.

● Ansul Chemical Company is the *only* fire extinguisher manufacturer maintaining extensive chemical research laboratories in addition to a large engineering staff for research and development to maintain and improve the quality of its products . . . *Plus* the most extensive, best-equipped proving grounds in the industry.

Ansul *"PLUS-FIFTY"*® Dry Chemical is non-corrosive, non-abrasive and non-toxic. It is safe to use on electrical fires of any voltage. And ANSUL extinguishers need only be inspected annually, NOT RECHARGED, adding ECONOMY to GREATER FIRE-STOPPING EFFECTIVENESS.

*Get the facts. See comparative effectiveness ratings for various types of approved fire extinguishers based on tests by nationally recognized approval agencies. Write for file No. 815. You will receive complete information and other valuable data.

ANSUL
CHEMICAL COMPANY
Fire Extinguisher Division
MARINETTE • WISCONSIN

OFFICES AND DISTRIBUTORS IN PRINCIPAL CITIES IN THE U. S. A., CANADA AND OTHER COUNTRIES
ALSO MANUFACTURERS OF INDUSTRIAL CHEMICALS, REFRIGERANTS AND REFRIGERATION PRODUCTS

methods and by exploratory drilling. Encouragement has been found on both the Canadian and American portions of Williston, with the oil discoveries on the United States side being of major importance. The Canadian discoveries so far this year include a small Mississippian limestone oil field in the Virden area of southwest Manitoba; a small Mississippian oil find in the Dahinda area of southern Saskatchewan which was of noncommercial volume, and natural gas and some oil encouragement in other portions of southern Saskatchewan.

In Central Saskatchewan, about 30 miles east of the Alberta border, there was a discovery of heavy crude oil made during August. An extensive development program is now under way in this region which is near the rail point of Coleville. Indications are that this discovery of 14°-gravity A.P.I. crude will cover an extensive area, and more than 60 ft. of oil-bearing Cretaceous sand has been encountered at some of the wells. A well now in progress is exploring the Devonian in search of production from that horizon.

The first well in British Columbia to show an important encouraging showing of light crude oil which is now undergoing a test period, is located in the Fort St. John area of that province, about 50 miles northwest of Dawson Creek. This well found its oil during a drill-stem test in the Permo-Pennsylvanian formation early in November. Gravity of the oil is around 38° A.P.I., but recovery during test was only 900 ft. of oil, 120 ft. of gassy mud, and 480 ft. of salt water. Whether or not the well will result in a commercial producer will be determined during the test period under way, but it has stimulated further exploratory operations for the region. The discovery team currently has a seismograph survey under way, and plans to drill a followup venture upon completion of that survey and of the testing at the discovery well.

Golden Spike Reservoir

(Continued from page 262)

From the analysis of a subsurface sample from the 1 Schoepp, the reservoir oil was determined to be undersaturated. The bubble-point pressure is 1,370 psig. at 150° F., compared to the original reservoir pressure of 2,095 psig. at the datum plane of —3,300 ft. When flashed to atmospheric conditions the fluid released 503 cu. ft. of gas per barrel of surface oil. The reservoir volume factor is 1.297 bbl. per barrel of surface oil and the gravity of the surface oil is 36.0° A.P.I.

By differential liberation, the fluid released 506 cu. ft. of gas per barrel of surface oil, and had a reservoir volume factor of 1.346 bbl. per barrel of

surface oil. Fig. 5 shows the gas solubility and shrinkage curves obtained by differential liberation.

The viscosity of the reservoir fluid varies from 0.89 cp. at the original reservoir pressure to 0.79 cp. at saturation pressure, and then increases with lower pressures. The compressibility of the reservoir temperature was 9.4×10^{-6} bbl./bbl./psi.

Oil in Place

The reservoir rock volume, determined by planimetering the contours in Fig. 1, was determined to be 607,000 acre-ft. Using an average porosity of 8 per cent, and an estimated average connate water value of 20 per cent, the original oil in place was calculated to be 301,400,000 reservoir barrels, or 232,000,000 stock-tank barrels.

Pressure-Production History

By September 1, 1951, a cumulative volume of 773,485 bbl. of stock-tank oil, or only about 0.3 per cent of the oil in place, had been produced. A pressure survey indicated the average reservoir pressure at this time to be 1,899 psig. at the datum plane of —3,300 ft., or a drop of 196 psi. from the original pressure of 2,095 psig. A summary of pressure-production statistics is shown graphically in Fig. 6.

As shown by the pressure-production data, the withdrawals to date have been replaced primarily by the expansion of the undersaturated oil. Using an oil-in-place of 301 million reservoir barrels, the laboratory determined compressibility figure of 9.4×10^{-6} bbl./bbl./psi., a total expansibility of 2,830 bbl./psi. is indicated. Up to the middle of August 1951, production had been about 4,000 bbl. per pound drop in pressure.

Although the pressure at first appeared to follow a straight line when plotted against cumulative production, during several periods of constant production rate, it has shown tendencies towards flattening out, indicating that a limited water drive might be present. The Alberta Petroleum and Natural Gas Conservation Board permitted the field to be shut in during January and February of 1951 in order to obtain pressure data with which the magnitude of any water drive could be accurately determined. During this period, numerous pressure measurements were made in all wells. While the data were somewhat erratic, a pressure buildup of only from 0 to 5 psi. was indicated, and a water drive was discounted as having any significant value in producing the pool.

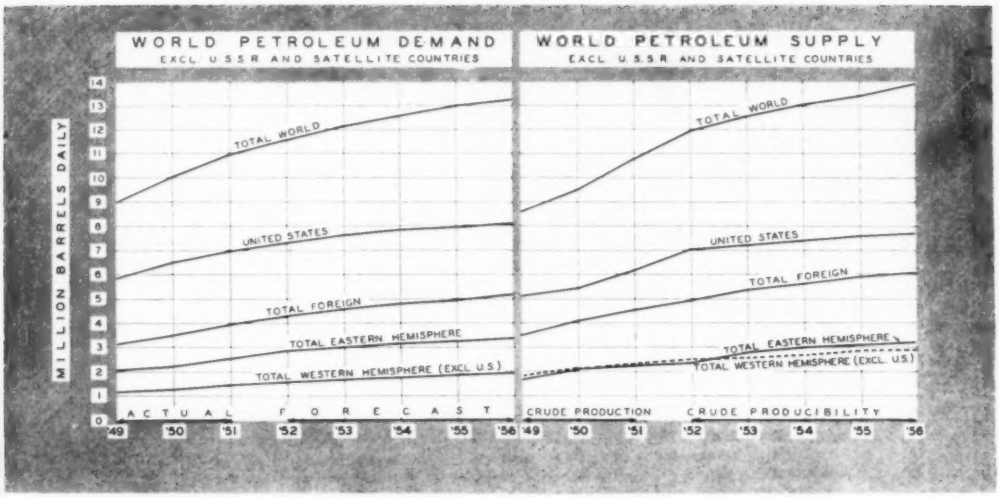
Future Pool Behavior

It is estimated that the oil in the top portion of the structure will decline to saturation pressure after a cumulative production from the pool of from 2.5 to 3 million barrels. After this time, either a gas-injection or water-injection program could be initiated for pressure maintenance.

However, due to the shape of the reservoir, and the apparent absence of any major barriers to vertical flow, gravity segregation will be the dominant factor controlling the pool behavior. A high recovery, in excess of 50 per cent of the oil in place, is indicated for almost any method of operation, but a considerable amount of study will be necessary to determine the optimum producing procedure. Because of the good communication in the reservoir, it is indicated that well density will not influence recovery efficiency.

Regardless of the method of exploitation, the oil production will be taken from either the top section or the bottom section of the formation. Assuming that this might be a zone 100 ft. in thickness, the recovery from the remaining 400 to 500 ft. of formation will be dependent only on the combination of gravity drainage with either solution gas drive, injected gas drive, or artificial water drive. It will be related in no way to the well spacing as long as the individual wells are produced efficiently, that is, with low enough drawdown that conditions of gas channeling or water coning do not arise. This is unlikely when the high individual well potentials, even without acidization, are considered.

. . . Insured against Corrosion!
There's no better corrosion insurance than Reilly pipe line enamels! Reilly pipe line enamels, made from coal tar, protect pipe line surfaces against corrosion, erosion and abrasion wherever the lines are laid. These enamels withstand extreme temperature conditions . . . their hard but flexible surfaces are highly resistant to wear . . . are ideally suited for use in wet or moist soils.
Reilly
PROTECTIVE COATINGS
REILLY TAR & CHEMICAL CORPORATION
MERCHANTS BANK BUILDING
INDIANAPOLIS 4, INDIANA



Larger percentage of oil supplies over next 5 years are to come from areas outside the United States.

World Demand to Continue Upward Trend

by Arthur D. Stewart*

Developments in global needs are dependent on political as well as economic factors. Present consumption outside the Soviet sphere nears record 11 million barrels daily

BASED on reports available to date, world demand for oil excluding U.S.S.R. and satellite countries very likely will reach the unprecedented average of 10,928,000 bbl. per day for the year just closing, an increase over last year of 920,000 bbl. per day or 9.2 per cent.

Demand forecasts throughout this article are based on the following assumptions:

1. No World War III expected during the next 5 years.

2. Increasing military oil requirements due to growth in size of standing armies, air force, and naval tonnage. Therefore, termination of the Korean conflict is not expected to reduce to any marked degree military oil requirements.

3. No drastic rationing of civilian consumption of petroleum products in the United States or in most countries abroad, although rationing may be reinstated in some foreign countries.

4. United States expected to continue for a number of years economic and military aid to allied powers.

5. The reduction in oil supplies from Iran not expected to seriously affect the world demand for oil.

6. The rearmament program in the United States and western Europe is not expected to retard seriously civilian consumption of oil.

World demand as presently foreseen will continue to rise during the next 5 years but the velocity will be considerably lower as compared with the years 1950 and 1951. The indicated future trend in motor-vehicle registrations, industrial production, and tonnage of oil-powered commercial vessels tends to support the oulook for continued rise in demand for oil.

Outlook for Demand in the United States

Domestic demand for crude and products in the United States will reach very likely the high level of about 6,971,000 bbl. per day for 1951, an increase of 472,000 bbl. per day or 7.3 per cent above the preceding year. A. J. McIntosh, Socony-Vacuum's economist, and R. W. Reinhart, manager of its market research department, foresee continued upward trend in domestic demand for each of the next 5 years, but a more moderate rate of growth is anticipated after 1953. A study of the principal major economic forces seems to support the outlook for continued strong demand for oil during the coming 2 years at least. United States industrial production capacity will be able very likely to produce goods for military and also for civilian needs to a limited extent and therefore it is foreseen that motor-car registration and oil burners in use will continue to rise, but slowly. Also no long or drastic deflationary period is expected to follow the peak of defense production. Furthermore, it now appears that United States economy for a number of years will have a supporting "floor" in the vast sums of funds appropriated by Congress to carry out the defense and foreign-aid programs

Outlook for Foreign Demand

According to a tabulation of available reports from abroad, total local foreign demand for crude and products should reach a level of about 3,957,000 bbl. per day for 1951, an increase of 448,000 bbl. per day or 12.8 per cent as compared with the year 1950. Substantial increases in local foreign demand have been maintained during each of the postwar years with an annual compound rate of 12.1 per cent per year that compares with only 6.4 per cent per year for the prewar years of 1934-1939. Continued upward demand is foreseen for crude and products demand for the years 1952-1956 inclusive. A discussion of the outlook for local demand in coun-

*Chief economist, foreign division, Socony-Vacuum Oil Co., Inc.

THEY SAID IT COULDN'T BE DONE

but GUIBERSON does it!

Double Duty Type "A" Flow Valve

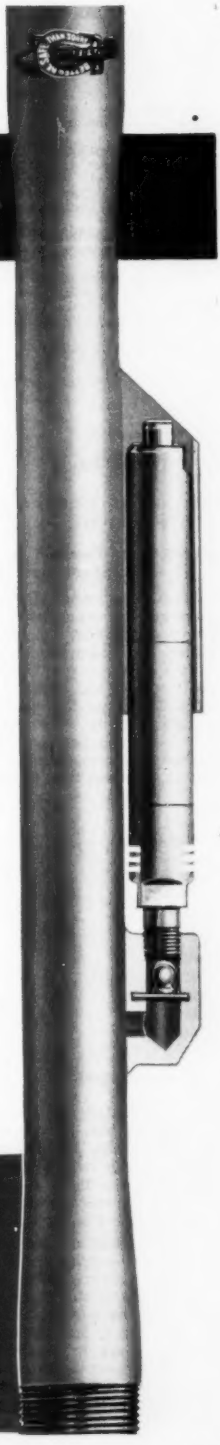
With Tungsten Carbide Ball and Seat

produces continuous or intermittent flow with only a surface equipment adjustment

Install Type "A" on any continuous flow operation. When production falls to a level where intermittent flow is required — *a simple surface adjustment* produces well with maximum efficiency and economy. No need to round trip tubing to change valves.

Guiberson Surface Control Equipment...

is designed and built specifically for gas lift. Rugged, weatherproof Type "A" Motor Valve and Time Cycle Controller or Pressure Controller are easy to get to, easy to operate, easy to adjust.



Write today for the new
GUIBERSON GAS LIFT MANUAL

THE
GUIBERSON
CORPORATION
ESTABLISHED 1919 • DALLAS, TEXAS, U. S. A.
Sold By Leading Oil Field Supply Stores Everywhere

Guiberson Gas Lift Equipment is protected by the following patents:
2,136,429 2,227,132 2,271,859 2,340,028 2,361,716
2,188,636 2,230,107 2,292,798 2,347,620 2,377,981
2,188,668 2,276,127 2,303,258 2,358,944 2,411,315
Other patents pending.

TABLE 1—WORLD PETROLEUM DEMAND
(Excl. U.S.S.R. and Satellite Countries)
(Thousands of barrels daily)

	Actual demand					Outlook for demand									
	1949	1950		1951*		1952		1953		1954		1955		1956	
	Bbl.	Bbl.	% inc. Vs. '49	Bbl.	% inc. Vs. '50	Bbl.	% inc. Vs. '51	Bbl.	% inc. Vs. '52	Bbl.	% inc. Vs. '53	Bbl.	% inc. Vs. '54	Bbl.	% inc. Vs. '55
United States	5,803	6,499	12	6,971	7	7,290	5	7,611	4	7,775	2	7,937	2	8,073	2
Other North America	595	660	11	703	7	745	6	788	6	831	5	875	5	919	5
Caribbean	205	235	15	316	34	375	19	388	3	401	3	414	3	426	3
Other South America	298	332	11	360	8	384	7	423	10	457	8	485	6	511	5
Total Western Hemisphere:															
Excluding United States	1,098	1,227	12	1,379	12	1,504	9	1,599	6	1,689	6	1,774	5	1,856	5
Including United States	6,901	7,726	12	8,350	8	8,794	5	9,210	5	9,464	3	9,711	3	9,929	2
OEEC countries—Europe	999	1,183	18	1,354	14	1,487	10	1,578	6	1,642	4	1,695	3	1,749	3
Other E. Hemisphere—west of Suez	245	274	12	309	13	331	7	351	6	366	4	382	4	397	4
Total E. Hemisphere—west of Suez	1,244	1,457	17	1,663	14	1,818	9	1,929	6	2,008	4	2,077	3	2,146	3
Middle East	327	333	2	345	4	388	12	395	2	400	1	406	2	414	2
Far East, S. and E. Africa and Oceania	452	492	9	570	16	611	7	653	7	692	6	727	5	764	5
Total east of Suez	779	825	6	915	11	999	9	1,048	5	1,092	4	1,133	4	1,178	4
Total Eastern Hemisphere	2,023	2,282	13	2,578	13	2,817	9	2,977	6	3,100	4	3,210	4	3,324	4
Total foreign	3,121	3,509	12	3,957	13	4,321	9	4,576	6	4,789	5	4,984	4	5,180	4
Total world	8,924	10,008	12	10,928	9	11,611	6	12,187	5	12,564	3	12,921	3	13,253	3

*Partly estimtaed.

tries abroad follows according to geographical areas:

Outlook for Demand in the Western Hemisphere (excl. U.S.A.)

Available reports indicate that the demand for crude and products for the year 1951 in the Western Hemisphere outside continental United States will reach a total of abut 1.4 million bbl. per day, an increase of 152,000 bbl. per day or 12 per cent as compared with 1950. A continuation of a rise each year in demand is expected during each of the next 5 years but at a slower rate as follows:

	Increase vs. prev. year per cent
Actual—	
1947	16
1948	9
1949	4
1950	12
1951	*12
Outlook—	
1952	9
1953	6
1954	6
1955	5
1956	5

*Partly estimated.

The indicated rise in demand from 1.4 million bbl. per day in 1951 to 1.9 million bbl. per day in 1956 (See Table 1) does not appear unduly optimistic in the light of past performance and viewed against a background of major economic indexes.

Industrialization in the Western Hemisphere outside the United States has made remarkable progress as compared with the years immediately preceding the outbreak of World War II. This trend has continued in the postwar years but conditions differ somewhat from country to country. Argentina's tightly controlled economy has not shown any growth in industrial production in the past years and present indications are that none may be expected in the near future. On the other hand, Brazil, Canada, and Mexico have shown uninterrupted growth and this development is expected to continue.

The war created sustained demand for the raw materials of the countries of the Western Hemisphere and the present rearmament program has maintained production at a high level. Agriculture has generally been modified compared with the 1930's. The monocultures (e.g. coffee in Brazil) are gradually giving way to a diversified agricultural program which no longer stresses only raw materials for export but also food grains and textile fibers for domestic consumption. This in itself is indicative of a higher standard of living and will also give impetus to the development of light industries in the food processing, textile, and clothing fields, thus further promoting a rise in the living standard.

Gold and dollar reserves had risen steeply in the war years as a result of heavy raw-material supplies to this country. These reserves were heavily drawn upon in the immediate postwar period to meet the pent-up demand for all types of merchandise. When it became apparent that these reserves were nearing depletion, controls were reinstated, imports brought in line with exports, and the importation of capital goods favored over the importation of consumer goods. The recent rearmament boom has brought about a renewed rise of gold and dollar reserves which for all of Latin America reached 3.7 billion dollars in 1951, a figure almost as high as that at the end of World War II in 1945. Since the main needs except for capital goods have by now been satisfied, it seems unlikely that gold and dollar assets will again be heavily drawn upon. Exports should on the whole be adequate to cover import requirements.

Unfavorable features in the generally bright picture are low labor productivity and often unstable political conditions. However, the favorable indexes considerably outweigh those considerations and continued expanding economy seems certain thereby supporting the outlook for rising demand for oil during the next 5 years.

Outlook for Demand in OEEC Countries—Europe

According to reports received to date, the total over-all demand for crude and products in the OEEC countries of Europe will amount to about 1,354,000 bbl. per day for the year 1951, an increase of 171,000 bbl. per day or 14 per cent as compared with the previous year. There has been a continuous and very high rate of growth in the demand for oil in western Europe during the past 4 years viz:

	Per cent increase vs. previous yr.
1948	10
1949	14
1950	18
1951	14

Among the fundamental factors to which this growth in demand may be attributed are the following:

1. U. S. Marshall plan aid.
2. Cooperative planning by the various international organizations and its various committees such as ECA, OEEC, etc.
3. The high rate of industrial activity.
4. Reduction in the deficit of the foreign trade account.
5. Increase in the intra-European trade.
6. Favorable effect on foreign exchange situation of the European Payments Union (E.P.U.).

Table 1 also gives an outlook for demand of crude and products in the OEEC countries of Europe for each of the coming 5 years. A continued

upward trend is indicated for demand viz:

	Per cent increase vs. previous yr.
1952	10
1953	6
1954	4
1955	3
1956	3

The outlook for crude and products demand in western Europe is in accordance generally with field estimates prepared and submitted for the most part about the middle of the current year. In view of the many uncertainties regarding the economic outlook in Europe together with the numerous political disturbances in the Eastern Hemisphere, the question arises as to whether these forecasts may or may not be on the optimistic side.

Among the many formidable problems facing western Europe, the worsening foreign exchange situation merits particular attention. It had been hoped that the European Recovery Program would result in European countries becoming self-sufficient with regard to foreign exchange particularly dollars. However, the rearmament program not only necessitates the diversion of sizable proportions of the productive capacity of western European countries from civilian production to defense production, thus depriving the export trade of goods which otherwise would have earned foreign exchange, but also causes the countries concerned to purchase abroad raw materials required for rearmament. The worsening dollar crisis is particularly severe in Great Britian. In the third quarter of 1951 gold and dollar reserves of the United Kingdom shrank by over 600 million dollars and in October 1951 by over 300 million dollars, the greatest decline in the reserves ever recorded. The foreign exchange crisis is, however, not confined to the sterling area. France shows not only a rising dollar deficit (37 million dollars in September 1951) but also a deficit with the sterling area (81 million dollars in July 1951). Other European countries face similar conditions. A solution may be found by instituting drastic controls to reduce domestic demand but it appears doubtful whether such controls alone would be sufficient and continued United States economic aid will probably be extended.

In view of these unfavorable conditions in Europe, the question arises as to the possibility of a return of rationing of civilian consumption of oil products, and also a reduction in the production of motor vehicles for civilian use. On the other hand, in view of the coal shortage, oil may be needed to carry out the rearmament program. Furthermore, the growth in size of the allied European army and additional military bases will very likely step up noncivilian requirements.

As to the probable demand for crude and products during the coming 5 years, it is well to consider the fact that the civilian demand in western Europe is related directly to the activity of:

1. Industrial production.
2. Agricultural production.
3. Transportation.

The indicated trend of these related factors tends to support the outlook for continued rise in demand for petroleum products in the OEEC countries, notwithstanding the many formidable problems facing western Europe.

Outlook for Demand in the Eastern Hemisphere—East of Suez

Total demand for crude and products in the Eastern Hemisphere east of Suez will exceed very likely 915,000 bbl. per day for the year 1951, an increase of 90,000 bbl. per day or 11 per cent, as compared with 1950. According to field reports continued upward trend in demand is foreseen for each of the next 5 years as set forth in Table 1. However, a more moderate annual rate of growth is indicated especially after the year 1953.

A study of economic conditions generally and of the major factors directly affecting the demand for oil seems to support the outlook for continuous upward trend in oil consumption in most countries east of Suez. Motor vehicle registrations will be larger and according to field reports the use of tractors and other oil-consuming equipment will increase due to further mechanization of agriculture and expanding industrialization generally. Economic conditions in the Eastern Hemisphere east of Suez have improved materially during the postwar years. Rehabilitation in the Far East area especially in petroleum,

TABLE 2—WORLD PETROLEUM SUPPLY—PETROLEUM CRUDE OIL AND ALLIED PRODUCTS PRODUCTION
(Excl. U.S.S.R. and Satellite Countries)
(Thousands of barrels daily)

	Crude production					Outlook—availability of crude supply producibility									
	1949	1950	% inc.	1951*	% inc.	1952	1953	% inc.	1954	% inc.	1955	% inc.	1956	% inc.
CRUDE OIL	Bbl.	Bbl.	Vs. '49	Bbl.	Vs. '50	Bbl.	Bbl.	Vs. '52	Bbl.	Vs. '53	Bbl.	Vs. '54	Bbl.	Vs. '55
United States	5,046	5,402	7	6,140	14	7,022	7,207	3	7,400	3	7,586	3	7,734	3
Other North America	226	278	23	338	22	440	496	13	549	11	610	11	663	9
Caribbean	1,459	1,648	13	1,865	13	1,906	1,956	3	2,001	2	2,051	2	2,096	2
Other South America	112	117	4	121	3	123	127	3	131	3	134	2	140	4
Total Western Hemisphere:														
Excluding United States	1,797	2,043	14	2,324	14	2,469	2,579	4	2,681	4	2,795	4	2,899	4
Including United States	6,843	7,445	9	8,464	14	9,491	9,786	3	10,081	3	10,381	3	10,633	2
OEEC countries—Europe	31	39	26	47	21	51	56	10	62	11	64	3	65	2
Other Eastern Hemisphere—west of Suez	44	45	2	48	7	47	47		47		47		47	
Total Eastern Hemisphere—west of Suez	75	84	12	95	13	98	103	5	109	6	111	2	112	1
Middle East†	1,394	1,749	25	1,893	8	2,120	2,370	12	2,545	7	2,610	3	2,725	4
Far East, S. and E. Africa and Oceania	204	238	17	270	13	274	305	11	325	7	343	6	360	5
Total east of Suez	1,598	1,987	24	2,163	9	2,394	2,675	12	2,870	7	2,953	3	3,085	4
Total Eastern Hemisphere	1,673	2,071	24	2,258	9	2,492	2,778	11	2,979	7	3,064	3	3,197	4
Total foreign	3,470	4,114	19	4,582	11	4,961	5,357	8	5,660	6	5,859	4	6,096	4
Total world	8,516	9,516	12	10,722	13	11,983	12,564	5	13,060	4	13,445	3	13,830	3
NATURAL-GAS LIQUIDS, ETC.:														
United States	431	498	16	562	13	610	650	7	690	6	730	6	770	5
Foreign	42	46	10	52	13	53	56	6	57	2	60	5	62	3
Total world	473	544	15	614	13	663	706	6	747	6	790	6	832	5
WORLD SUPPLY—RAW MATERIALS:														
United States	5,477	5,900	8	6,702	14	7,632	7,857	3	8,090	3	8,316	3	8,504	2
Foreign	3,512	4,160	18	4,634	11	5,014	5,413	8	5,717	6	5,919	4	6,158	4
Total world	8,989	10,060	12	11,336	13	12,646	13,270	5	13,807	4	14,235	3	14,662	3

*Partly estimated. †Iran not included years 1952-1956 inclusive.

TABLE 3—WORLD PETROLEUM CRUDE-OIL REFINING CAPACITY

(Excl. U.S.S.R. and Satellite Countries)

(Thousands of barrels daily)

	Actual refining capacity*					Outlook for refining capacity*			
	1950			1951		1952		1953	
	1949 (bbl.)	Bbl.	% inc. Vs. '49	Bbl.	% inc. Vs. '50	Bbl.	% inc. Vs. '51	Bbl.	% inc. Vs. '52
United States	6,567	6,830	4	6,975	2	7,350	5	7,825	6
Other North America	509	562	10	620	10	664	7	715	8
Caribbean	1,040	1,174	13	1,230	5	1,304	6	1,314	1
Other South America	182	216	19	249	15	251	1	278	11
Total Western Hemisphere:									
Excluding United States	1,731	1,952	13	2,099	8	2,219	6	2,307	4
Including United States	8,298	8,782	6	9,074	3	9,569	5	10,132	6
OEEC countries—Europe	674	913	35	1,046	15	1,332	27	1,471	10
Other Eastern Hemisphere—west of Suez	152	171	13	180	5	185	3	220	19
Total Eastern Hemisphere—west of Suez	826	1,084	31	1,226	13	1,517	24	1,691	11
Middle East†	844	867	3	887	2	887		887	
Far East, South and East Africa and Oceania	210	284	35	304	7	320	5	357	12
Total east of Suez	1,054	1,151	9	1,191	3	1,207	1	1,244	3
Total Eastern Hemisphere	1,880	2,235	19	2,417	8	2,724	13	2,935	8
Total foreign	3,611	4,187	16	4,516	8	4,943	9	5,242	6
Total World	10,178	11,017	8	11,491	4	12,293	7	13,067	6

*As of July 1. †Iran included all years.

rubber, and tin production, has been rapid and at a sustained rate. Rubber and tin production far exceed prewar production. Statistics of industrial activity in South Africa, India, and Australia have reflected continuous upward trends in growth and volume of output. Japan's industrial recovery has been little short of astounding. During the latter half of 1951, Japan's industrial production exceeded the levels reached during the prewar years 1935-1939.

United States aid in the form of loans, grants, and technical assistance has and will continue to improve the general economic outlook. However, a word of caution regarding the long-term outlook for the area is a necessary corollary. Industrial prosperity in Japan has been primarily due to the huge demand of the U. N. armies in Korea and to increased action of U. S. Army and Navy in Japan proper. Japan will have to obtain other markets to replace these outlets that will terminate or will be greatly reduced upon cease-fire in Korea.

Another factor to be considered is the fact that the economy of this area east of Suez is wholly or to a large extent dependent on world

GRIFFENHAGEN & ASSOCIATES

ESTABLISHED IN 1911

Consultants in Management

MANAGEMENT

CHICAGO

333 North Michigan Avenue

Telephone RAndolph 6-3686

New York • Boston • Washington • Milwaukee

Dallas • Los Angeles • Montreal

In their 40th anniversary year, and with extensive experience in the oil industry, Griffenhagen & Associates are in a better position than ever to render to oil companies counsel and active assistance on projects having to do with:

Organization structure, organization manuals, and management guides;

Management and operating procedures, management controls, and the quality and effectiveness of supervision and performance at all levels;

Position classification and evaluation, wage and salary plans, selection, training, and utilization of personnel, performance rating, executive development, employee relations, employee benefits plans, personnel records, and personnel administration generally;

General and cost accounting, operating reports, capital and operating budgets, and budgetary controls;

Materials management, article identification, cataloging, spare parts listings, the determination of stock position and requirements, purchasing, storehouse operations, stock accounting, inventory controls, and physical inventorying;

Property management, including records and procedures essential to assignments and control of mobile equipment;

Transportation management and operations and traffic management; or

Office management, general office services, forms design and standardization, office records and procedures, internal communication.

Inquiry as to how the firm might assist on any particular problem entails no obligation.

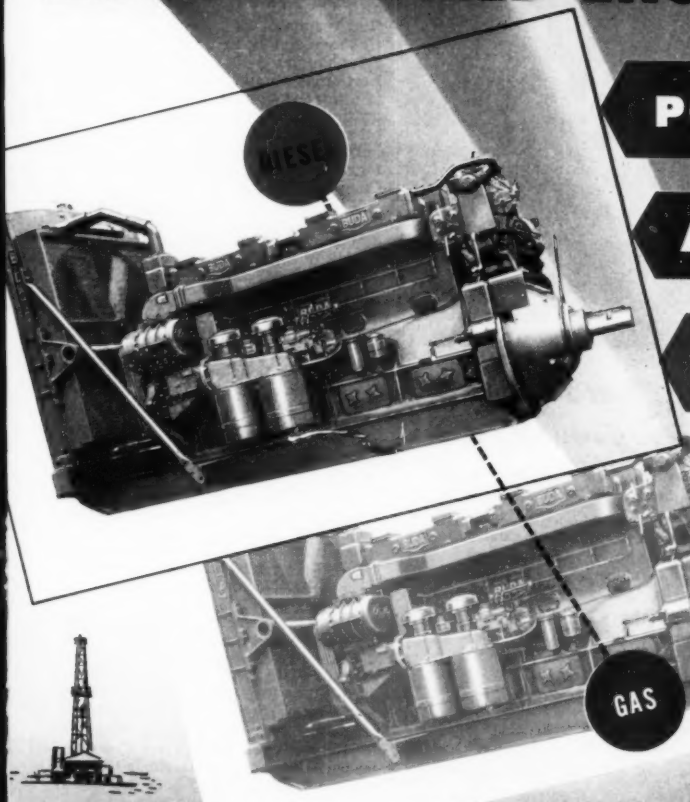
BUDA

"2505" OILFIELD ENGINES . . .

POWER . . .

ACCELERATION—

and DOUBLE PROTECTION



BUDA "2505" Series Engines and the "Fuecomizer" Kit which permits conversion from full Diesel to full gas or vice versa, gives you the pick of the cheapest fuel . . . double protection against high fuel costs for little more than the price of one engine. Ask your nearby Buda Oilfield Distributor about Buda's 2 in 1 "2505" Engine Deal today. Data and Specifications furnished without obligation.

The Buda Company, Harvey, Ill.

BUDA Oilfield Distributors are located in: Dallas • Tulsa • Los Angeles • Houston • Oklahoma City • Seminole • Wichita Falls • Shreveport • Bakersfield • Tyler • Pampa • Great Bend • Long Beach • Kilgore • Mt. Carmel, Ill. • Alice • Odessa • Casper • Denver • Brookhaven • New York City (Export) and in Canada at Calgary and Edmonton

prices for raw materials, such as rubber, tin, jute, wool, etc. Any drastic decline in the volume of demand or reduction in world prices for these commodities will have an immediate and adverse effect on the well being and prosperity of the countries east of Suez generally.

Outlook for World Supply

According to all available data, world crude oil and allied products production (excluding the U.S.S.R. and satellite countries) will very likely reach a record high of approximately 11.3 million bbl. per day for 1951, a gain of almost 1.3 million bbl. per day or 12.7 per cent over 1950. There has been substantial rise in world crude-oil production during each of the past 5 years with the exception of the year 1949. A continued upward normal rate of growth for world crude oil producibility is indicated for each year. It is assumed that sufficient steel and other materials will be made available to carry out the development of crude-oil production. Due to the uncertainty regarding crude-oil production in Iran, world outlook for crude-oil producibility is presented with and without Iranian production.

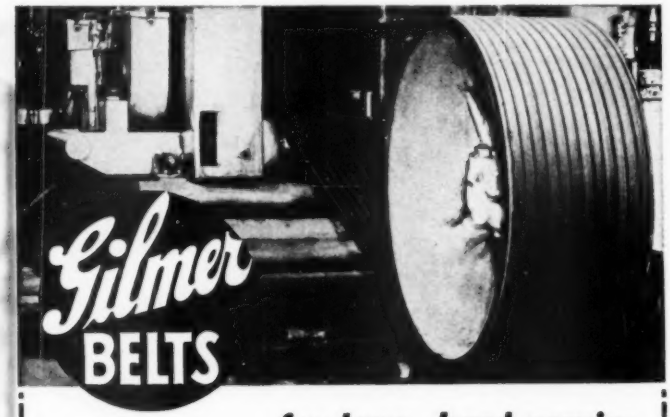
Actual world production of crude and allied products for the years 1949, 1950, and 1951 and the outlook for producibility of crude oil and allied products according to geographical areas is presented in Table 2. This table points up the important fact that there was substantial growth in Middle East production during 1951 despite the severe curtailment and eventual shutdown of production in Iran during the latter half of the year. Production of crude oil in the Middle East is expected to reach a new high of 1.9 million bbl. per day in 1951, an increase of almost 150,000 bbl. per day or 8 per cent over 1950. This points up the fact that a substantial portion of the loss of Iranian oil has been offset by increased production in other Middle East producing countries, principally Kuwait and Saudi Arabia. The outlook for the Middle East is for continued larger available supplies of oil during each of the coming 5 years despite the fact that estimates of Iranian producibility have not been included in Table 2 for the years 1952-1956. In this connection it should be mentioned that if crude production and refinery operations in Iran are resumed Iranian oil may regain many of its old markets due to its geographical advantage, its being nondollar oil, and refinery at Abadan.

With reference to the other large producing areas, i.e., the United States and the Caribbean area, increases of only 2 to 3 per cent are indicated for the years 1953-1956, inclusive.

In view of the tense political world situation that has resulted in actual armed conflicts in Korea, Indo-China, Malaya, and Burma along with the semimobilization in the United States and Western Europe, it is important to know to what extent the petroleum industry could provide crude oil from MER production over and above anticipated semipeacetime demand. The world petroleum industry could provide crude oil at MER rate of production over and above a semipeacetime demand to the extent of about 1 million bbl. per day in 1952 rising to 1.4 million bbl. per day in 1956 or a world shut-in production ranging from 8 per cent to 10 per cent. A settlement of the Iranian problem making available crude and products from that area would increase world shut-in production to 1.8 million bbl. per day in 1952 and to 2.3 million bbl. per day in 1956 or a margin of safety ranging from 13 to 15 per cent. However, it should be borne in mind that although world crude-oil producibility is in excess of and is rising faster than present foreseeable demand, the actual development of crude productive capacity will very likely follow the actual trend of world demand.

Outlook for World Refining Capacity

According to a tabulation of data compiled from various sources pertaining to plans for expansion and erection of new plants, total world crude-oil refining capacity will continue to rise during the next 2 years.



for long, hard service on heavy-duty jobs

GILMER MULTIPLE V-BELTS

ALWAYS you can count on Gilmer V-Belts for strong pulling power. In design and construction they're built to stand up under the most rugged demands of oil field service.

Gilmer V-Belts are firm-gripping; straight wall construction assures full contact with sheaves. Their extra strong Rayon pulling cords can handle your heaviest loads. And the cords are locked in parallel, cushioned in live rubber, and *correctly positioned* to give you cool-running, smooth-flexing, uniform belt performance. Tough multiple jackets withstand the toughest wearing conditions met in oil field service.

You can get Gilmer Multiple V-Belts, standard or special, endless or non-endless, for every drive.

Write for FREE copy of the fact-packed Gilmer V-Belt Guide. And for top-quality transmission, always specify Gilmer V-Belts.

BUY THROUGH YOUR GILMER DISTRIBUTOR

Bovaird Supply Co. Wilson Supply Co. Globe Sales Co.

L. H. GILMER COMPANY

1209 Tacony, Philadelphia 35, Pa.

Division of United States Rubber Company

V-BELTS • FLAT BELTS • HOSE • PACKING • TAPE

Concrete information regarding specific projects programed for completion during the years 1954 to 1956 is not presently available, and therefore no estimate has been made of refining capacity after 1953.

World refining capacity will rise from about 11.5 million bbl. per day in 1951 to about 12.3 million bbl. per day in 1952, a gain of about 800,000 bbl. per day or 7.0 per cent. In the year following, refining capacity is expected to exceed 13 million bbl. per day, or an increase of 774,000 bbl. per day or 6.3 per cent.

World refining capacity according to geographical areas is presented in Table 3 which points up several significant facts as follows:

For the United States a larger growth in refining capacity is planned for 1952 and 1953 than in previous years. This is in line with the announced recommendation of the Petroleum Administration for Defense that refining capacity in the United States should be increased by 1 million bbl. per day. It is now understood that by the middle of 1952 United States refineries will no longer have to produce products for export to Europe in part replacement of Abadan products and that by that time facilities will have been sufficiently expanded elsewhere to replace in full the lost Iranian oil.

The healthy growth in refining capacity in other North American countries mainly reflects additional refinery construction in Canada as a result of increased crude production there. The more modest rise in the Caribbean is largely due to refinery construction in Venezuela much of which is undertaken in line with the terms of the concession contracts that make the erection of a certain amount of refining capacity mandatory if crude production is developed. South American refining capacity is expected to grow due to construction in Brazil and Chile.

The very rapid growth of refinery capacity in Europe is tapering off. This spectacular building program was largely prompted by a desire of European countries to have foreign exchange by substituting the importance of crude oil for that of finished products. The Marshall plan gave impetus to these plans and most construction projects will be completed by 1953. By that time refining capacity in France, Italy and the Benelux countries is expected to exceed domestic demand, leaving considerable quantities available for export. United Kingdom and western Germany will be nearly self-sufficient, leaving only the smaller consuming countries as importers of a significant proportion of their product requirements. Thus the avowed aim of making the OEEC countries of Europe self-sufficient in refining capacity will be almost reached by 1953 when refining capacity will reach 1,471,000 bbl. per day and demand 1,578,000 bbl. per day.

In the area east of Suez (exclusive of the Middle East) capacity is expected to grow by 5 per cent in 1952 and by 12 per cent in 1953. If plans published so far materialize, the growth in that part of the world will be sustained and may be accelerated. In addition to projects already reflected in Table 3 further refinery construction projects have been announced, for example, for Australia. The Philippines and other locations are under consideration and it seems probable that, at least in the more important consuming countries, local refining of imported crude will increasingly replace imported products. Added impetus has been given to all these plans by the shutdown of Abadan which has hit the countries in the Indian Ocean area particularly hard.

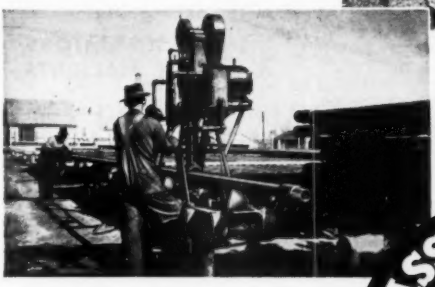
Table 3 does not reveal the technical aspect of planned new or expanded facilities. It is generally known, of course, that United States refineries are equipped with cracking facilities and that in particular catalytic cracking has steadily been replacing thermal cracking for some time. Very little modern cracking capacity existed in the Eastern Hemisphere as recently as 3 or 4 years ago but this situation is changing rapidly. Most of the refinery construction and expansion programs every-

DRILL PIPE FOR RENT

ALSO
- DRILL COLLARS
- KELLYS
- KELLY DRIVE BUSHINGS
- CORE BARRELS
- SAFETY JOINTS
- ROTARY SLIPS
- BLOWOUT PREVENTERS
- ROTARY TONGS
- ELEVATORS
- ROTARY SUBS

No need to tie-up operating capital in drilling equipment! Just call "Associated"! Drill pipe and tools are maintained in excellent condition, ready for immediate delivery on rental basis. All six yards (listed below) are equipped to give you fast 24-hour service!

(*Right*) All pipe returned to our yards is steam cleaned and rigidly inspected.



(*Left*) Returned pipe is straightened, repaired to first class condition and threads properly lubricated before being replaced on racks.

MAIN OFFICE — HOUSTON, TEXAS

HOUSTON, TEXAS Phone CApitol 9596
OKLAHOMA CITY Phone 62-3555
ALICE, TEXAS Phone 1348
NEW IBERIA, LA. Phone 1553-J
ODESSA, TEXAS Phone 2331
HARVEY, LA. Phone UPtown 8585
CASPER, WYO.

ASSOCIATED A OIL FIELD INC. RENTALS

where make provision for catalytic cracking facilities either at present or as future additions and sometimes also for other modern refining processes. These developments will result in products of better quality for those markets, and in providing greater flexibility to cope with changing supply and demand conditions.

A comparison of changes in refining capacity in various parts of the world, as reflected in Table 3 shows clearly that most of the foreign refinery capacity is erected in the consuming countries and no longer close to production. This is a distinct change from prewar conditions. Most of the refineries built outside the United States in the period between the two world wars were located in or close to the major producing countries, for example, Aruba and Curacao adjacent to Venezuelan crude, Abadan for Iranian crude, Haifa for Iraq crude, refineries in Indonesia, and Romania for crude produced in those countries, etc. No significant expansion of these "export refineries" has been made or seems to be contemplated. By having refineries in the consuming countries the latter are able to import crude instead of finished products and thus save on badly needed foreign exchange.

During the last 5 years the world's refineries operated at 83 to 90 per cent of rated capacity, but at 94 per cent or higher after the shutdown of Abadan. If Abadan remains inoperative, the refineries would have to operate at more than 90 per cent capacity.

Refining experts seriously question whether sustained operation of overall refining facilities at such high rates of capacity will be practical. It must be remembered that this high rate of operation can only be attained in practice because some refineries actually operate at more than 100 per cent of rated capacity. This may entail quality sacrifices particularly as regards gasoline octane ratings. It also frequently results in refinery yields being determined by maximum crude input rather than by market demand. If the resulting imbalance, product by product, proves serious, an adjustment of refinery yields may become imperative and force operation down to a lower percentage of rated capacity. This may in turn lead to shortages in some products.

Even if actual shortages do not develop, it seems only reasonable to acknowledge that refining capacity is likely to be a danger spot and possible bottleneck in the flow of oil from well to consumer. With a margin between rated capacity and actual operation as low as the one to be expected in 1952 and 1953 if Abadan is not operative, there will be no cushion left to absorb the shocks of additional dislocations and emergencies. It is well to remember that the United States was called upon, at short notice, to supply 190,000 bbl. per day of refined products to other countries to compensate in part for the loss of Abadan and that increased crude runs in foreign refineries made up a good deal of the balance. If similar emergencies are to be met successfully in the future, larger spare refining capacity than now indicated would be desirable.

Transportation of Crude and Refined Products

Whereas supplies of crude would appear to be adequate to take care of anticipated requirements in the next years, the position with regard to transportation of crude and products and with regard to containers will largely depend upon the availability of steel and other materials. It is to be hoped that at least enough materials will be made available to the petroleum industry to take care of essential requirements of crude-gathering pipe lines, crude and product trunk lines, of storage facilities, of tankers and inland craft, and of containers of all types.

About 8,000 miles of crude and products trunk lines have been completed here and abroad in 1950 and similar mileage is likely to be constructed in 1951. Of the projects now under way or still in the planning stage the following are of particular interest:

Several alternative projects for crude lines from Alberta to the Pa-

You'll want it for the SUPER JOB it does — for so little . . .

Thompson SELF-MOTIVATED SHALE SEPARATORS & SAMPLE MACHINES

- PROVEN PERFORMANCE
- ECONOMICAL OPERATION
- SAVES DRILLING COSTS

No drilling outfit today can afford to be without a Thompson. The Thompson does a two-fold job and does it better: (1) it thoroughly removes the shale and abrasives from valuable drilling mud, and (2) the SAMPLE MACHINE (standard equipment on all Thompson Separators) collects foot-by-foot cuttings to give an accurate analysis of the progress of the well. Drillers as well as geologists recognize this sample machine as one of the simplest and most economical methods of obtaining true samples.

Standardize on THOMPSON! YOU'LL SEE . . .
SOLD THROUGH SUPPLY STORES EVERYWHERE!

THOMPSON TOOL CO.
IOWA PARK, TEXAS

cific Coast to make increased production in Canada possible.

Increase of capacity of the Interprovincial Pipe line by erection of additional storage facilities.

Platte Pipe line from Wyoming to Illinois.

West Texas Gulf Pipe line.

Iraq Petroleum Co.'s pipe line from Kirkuk, Iraq, to Banias, Syria, which will result in greatly increased production in Iraq.

Product lines have hardly existed so far in the Eastern Hemisphere. A line from LeHavre to Paris is nearing completion; a line is planned from Ango-Ango to Leopoldville in the Belgian Congo, and another one is contemplated to link Beira in Portuguese East Africa with Rhodesia.

Pipe lines are at present operating at close to capacity. If sufficient steel cannot be made available to meet the most essential needs, transportation bottlenecks may ensue.

In line with increasing oil consumption, steadily increasing oil quantities are carried by tankers. The following table shows to what extent oil-tanker tonnage has increased in the last 4 years.

WORLD TANKER FLEET

(Thousands of deadweight tons)

	Deadweight tons	Increase vs. —Prev. yr.— Tons	%
Dec. 31, 1947	23,801		
Dec. 31, 1948	24,410	609	2.6
Dec. 31, 1949	25,667	1,257	5.1
Dec. 31, 1950	27,616	1,949	7.6
Dec. 31, 1951*	29,700	2,084	7.5

*Increase up to June 30, 1951, projected to year's end.

On June 30, 1951, oil tankers of 1,000 tons gross and upwards under construction in the world amounted to 181 ships aggregating over 2 million tons gross (better than 3 million deadweight tons) representing 38.4 per cent of the total merchant vessel tonnage under construction in the world. Orders placed with shipyards are reported to keep pace with ships launched and completed so that a continued growth of the world's tanker fleet may be expected, provided the necessary materials are available.

In spite of the sustained tanker construction program, it is the prevailing opinion of experts in the trade that all available tonnage will have to be utilized to best advantage to meet the rising demand unless hostilities in Korea cease and the pace of rearmament slackens as well.

Conclusions

1. Political factors loom unprecedentedly large and make the outlook uncommonly uncertain. Petroleum demand and supply will quickly respond to changes in such factors.

2. The available crude supply is adequate to meet currently anticipated demand but spare production capacity may not be sufficient to cope with considerably larger requirements in case of serious emergencies.

3. Transportation, particularly by tanker, will be tight very likely unless military activities and rearmament fall considerably below present expectations.

4. Refining will probably continue to be a potential bottleneck for several years. There will be very little reserve capacity to deal with unforeseen increased demand or with emergencies.

5. Additional refining facilities will be erected primarily in the main consuming centers rather than near crude-oil producing centers. Europe will soon be almost self-supporting in refining capacity, and refinery construction east of Suez is expected to progress steadily during the coming decade.

6. The Middle East is fast becoming the predominant source of crude for the entire Eastern Hemisphere. Any trouble affecting Middle Eastern oil supplies endangers the countries dependent on those supplies and therefore concerns the United States.

7. The scarcity of dollars will very likely continue to remain of prime concern to the United States petroleum industry in its foreign operations. Nondollar oil will frequently have an advantage over dollar oil. United States oil companies operating abroad may have to find means enabling them to accept a greater proportion of nondollar currencies.

8. Resumption of Iranian crude production and refinery operation might present the world oil industry with some problems of readjustment.

9. The high level of economic activity in the United States, and to some extent elsewhere, is artificially stimulated. Reduced rearmament activities may result in lower requirements for petroleum products than now foreseen. Such developments might radically change the outlook from one of tight supplies to one of excess supplies. The industry will have to watch all developments with great care to assure that its plans are continuously adjusted to meet changing conditions, so that costly over expansion and over investments can be avoided.

DURING DRILLING OPERATIONS the thin wall cake formed with KEN-OIL stays in place. It has a total lack of plugging material... disintegrates in crude oil when well comes on production, thus eliminating any chance of mudding off the pores of the oil zone. KEN-OIL reduces completion and clean-up time.

The soft filter cake of KEN-OIL enables good results to be obtained with electric logging equipment.

KEN-OIL oil base Drilling Fluid increases production, minimizes drilling troubles. Write for complete information.

KEN CORPORATION
OIL WELL DRILLING FLUIDS
2425 Gundry Avenue, Long Beach 6, Calif.
205 Irwin Keasler Bldg., Dallas, Texas

Distributors: Mud Control Laboratories, Inc., 150 E. Midwest St., Casper, Wyoming
1832 W. Reno St., Oklahoma City, Okla.; 111 N. Big Spring St., Midland, Texas
Petroleum Industries Consultants C.A., Apartado 1953, Caracas, Venezuela.

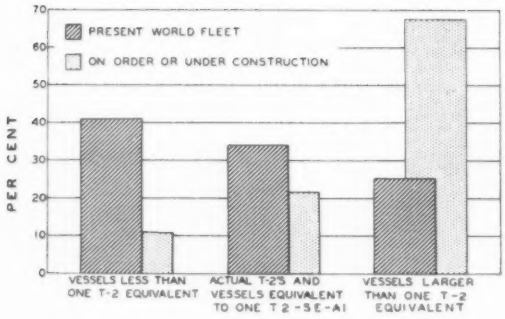


Fig. 1—Tankers of large capacity feature new construction.

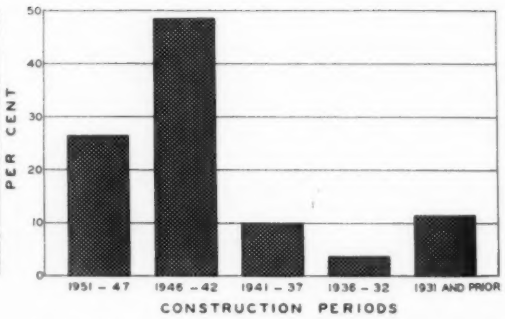


Fig. 2—Recent tanker construction is second only to war period.

THE WORLD'S TANK-SHIP FLEET

. . . an analysis

by Benedict Saurino*

The 625 tank ships under construction at start of 1952 are equivalent in capacity to 40 per cent of present world fleet

ON September 1, 1951, there were on order and under construction 561 tank vessels of about 10,700,000 d.w.t. and having an average speed of 14.6 knots, or approximately the same as the rated T-2 speed (Table 7). Because of larger average size, these 561 tankers were equivalent to some 657 T-2's in carrying capacity. Some 32 T-2's are scheduled to be delivered in the latter part of 1951 leaving 625 T-2's of this program for future construction on January 1, 1952. These vessels represent nearly 40 per cent of the world tank-ship fleet estimated for the beginning of 1952.

Under the multiple impact of world-wide defense preparations, the Abadan refinery shut down, and the sharp increase in world demand for petroleum and its products, there was experienced in 1951 a close balance between the availability and requirements for commercial petroleum tankers. While greater abnormalities in world petroleum flow may have affected the 1951 tank-ship balance, actual petroleum movements have been established by origin and destination ports for the more normal year of 1950.

Based on this world flow of crude oil and products, (Tables 5 and 6), commercial petroleum trade alone in 1950 required the services of 1,203 T-2 equivalent tankers. When considering tank ships of 6,000 d.w.t. and over, there were available in 1950 an average of 1,199 T-2's for

*Manager, statistical research division, Sun Oil Co., Philadelphia.

TABLE 1—TANKER GROWTH WILL CATCH UP WITH NEEDS IN 1954

Year	Estimated world crude-oil production (bbl. daily)	T-2 equivalent computed world tank ships required	T-2 equiv. est. avg. tank ships available (no scrappage)	T-2 equivalent long (+) or short (—)
1952	11,295,000	1,694	1,652	—42
1953	11,791,000	1,771	1,770	— 1
1954	12,310,000	1,853	1,872	+19
1955	12,851,000	1,937	1,967	+30
1956	13,415,000	2,026	2,062	+36
1957	14,005,000	2,113	2,157	+39

TABLE 2—NEW TANKER CAPACITY TO CENTER IN LARGE UNITS

	Present fleet		September 1, 1951 construction program	
T-2 capacity—	T-2's	Per cent	T-2's	Per cent
Smaller than	649	41.0	71	11.0
Equivalent	538	34.0	142	22.0
Larger than	402	25.0	444	67.0
Total	1,589	100.0	657	100.0

TABLE 3—BULK OF NEW CONSTRUCTION OUTSIDE UNITED STATES

	U. S. yards	All foreign	Total	Cumulative
September-December 1951	0.0	31.7	31.7	31.7
Year 1952	31.5	95.0	126.5	158.2
Year 1953	14.0	95.0	109.0	267.2
Year 1954	0.0	95.0	95.0	362.2
Year 1955	0.0	95.0	95.0	457.2
Year 1956	0.0	95.0	95.0	552.2
Year 1957	0.0	95.0	95.0	647.2
Year 1958	0.0	9.4	9.4	656.6
Total program	45.0	611.1	656.6	

TABLE 4—POSTWAR TANKER CONSTRUCTION GREATLY EXCEEDS PREWAR

			Cumulative		Over-age period
Construction period—	T-2's	Per cent	T-2's	Per cent	(20 years)
1931 and earlier	183.3	11.5	183.3	11.5	Present
1932-1936	58.1	3.6	241.4	15.1	1952-1956
1937-1941	158.3	10.0	399.7	25.1	1957-1961
1942-1946	770.5	48.5	1,170.2	73.6	1962-1966
1947-1951	418.9	26.4	1,589.1	100.0	1967-1971
Total	1,589.1	100.0			

TABLE 5—T-2 TANKER FLOWS OF CRUDE OIL AND PETROLEUM PRODUCTS INTO MAJOR AREAS BY ORIGIN, 1950

Origin and destination—	Tankers to move: Crude	Tankers to move: Products	Total T-2 tankers
East Coast, U. S. from:			
California		23	23
Gulf Coast, U. S.	54	123	177
Caribbean	41	40	81
Mexico	5	3	8
Persian Gulf	84		84
Near East	1		1
Total	185	189	374
Europe, N. Africa, Near East, Persian Gulf from:			
United States*	1	13	14
Mexico	4	2	6
Caribbean†	31	76	107
Near East	26		26
Persian Gulf‡	235	107	342
Other Latin America	1		1
Europe§		7	7
Oceanic		3	3
Total	298	208	506
Oceania (exc. Hawaii) from:			
United States		1	1
Caribbean and Europe		1	1
Persian Gulf	1	33	34
Oceania	2	6	8
Total	3	41	44
South and East Asia from:			
United States	3	4	7
Persian Gulf	7	37	44
Oceania	1	13	14
Total	11	54	65
West Coast, U. S., western Canada, Alaska, Hawaii from:			
West Coast to West Coast, U.S.	7	20	27
West Coast to Canada	3	6	9
West Coast to Alaska		(**)	(**)
West Coast to Hawaii		4	4
Total	10	30	40
Other Latin America and Caribbean from:			
United States	1	8	9
Caribbean¶	10	49	59
Other Latin America	2	2	4
Persian Gulf	22	2	24
Oceanic	3		3
Total	38	61	99
Canada (eastern) from:			
Caribbean	19	4	23
Near East	1		1
Persian Gulf	25		25
Total	45	4	49
South and East Africa from:			
United States		1	1
Persian Gulf		18	18
Total		19	19
West Africa from:			
Caribbean		7	7
Total		7	7
Total world tanker flow above	590	613	1,203
Balance			5
Total world tanker flow 1950 in T-2 equivalents			1,208

	Crude	Products
*Incl. U. S. to Persian Gulf		1
†Incl. Caribbean to N. Africa	1	4
‡Incl. Persian Gulf to N. Africa	3	6
Incl. Persian Gulf to Near East	1	21
§Incl. Europe to Europe	5	
Incl. Europe to N. Africa		1
Incl. Europe to Near East		1
¶Incl. Caribbean to Caribbean		5

**Less than 0.5.

ocean-going petroleum transportation.

In a recent study prepared for Petroleum Administration for Defense, it was necessary to develop a statistical forecasting method for estimating world tank-ship requirements several years ahead. A high relationship was found to exist between the world production of crude oil and the tanker fleet during the half century 1900-1950. About 98 or 99 per cent of the changes in the world tanker fleet were directly related to changes in crude-oil production. Admittedly, this high degree of correlation could be reduced in the future by sudden shifts in supply and/or consumption areas and, also, by large pipe-line completions within any short time span in such areas as the Middle East or United States Gulf to East Coast.

Accepting these limitations, the outlook for the next several years when based on the correlation formula would be in the order of magnitude as shown in Table 1.

An acceptance of the basic assumptions contained in the above computation would conclude that the present tight tanker market will continue for the next 2 years. Additionally, a close statistical balance will exist from 1954 through 1957.

As in any prognosis, a number of important conditions and problems are contained in these conclusions.

Why Tanker Demand And Supply Balanced

Tanker tonnage required for commercial petroleum trade was slightly higher in the Eastern than in the Western Hemisphere, both on the basis of cargo origin and by destination.

Because of longer hauls, as well as volume carried, cargoes originating in the Persian Gulf area required 47 per cent of the 1,208 T-2's engaged in petroleum trade during 1950, or an amount slightly greater than the tonnage used in the entire Western Hemisphere movement.

Gross tanker movements for coastal, intercoastal, export, and import trade of the United States accounted for 448 T-2's or 37 per cent of world petroleum trade.

World tanker tonnage requirements were about evenly divided between crude oil and petroleum product cargoes, but wide differences occurred between individual supply areas.

Seasonal peak requirements from November to April reach a high of 11 per cent in January above average monthly tanker needs for the year in the United States trade north of Hatteras.

Peak seasonal tanker needs in January 1950 were 56 T-2's above the average monthly requirements for the year and represented the equivalent of 15,000,000 bbl. of on-shore storage.

TABLE 6

Relative Utilization of World Tank-Ship Fleet for Commercial Petroleum Trade in 1950

(By point of origin and also by destination)

Area—	Per cent: By point of origin	Per cent: By point of destination
United States	22.8	33.2
Caribbean	22.9	0.7
South America	0.4	7.5
Other Western Hemisphere	1.1	4.9
Total W. Hemisphere	47.2	46.3
Europe	0.6	38.3
Near East	2.3	2.1
Persian Gulf	47.4	0.1
Oceania	2.5	3.9
Other Eastern Hemisphere	0.0	9.3
Total E. Hemisphere	52.8	53.7
Total world	100.0	100.0

Gross U. S. movement	T-2's	% of world
United States to:		
United States	227.8	18.8
Others	46.9	4.0
United States from:		
Others	173.3	14.3
Total U. S. flow	448.0	37.2

TABLE 7—TANK SHIPS ON ORDER OR UNDER CONSTRUCTION IN WORLD, BY COUNTRY OF CONSTRUCTION, SEPTEMBER 1, 1951

(Ocean-going vessels 6,000 deadweight tons and over)

Country of construction—	No.	Deadweight tonnage	T2-SE-A1 equivalents	Per cent of world	Average speed (knots)
United States	26	659,650	45.5	6.9	16.5
Belgium	6	88,720	5.4	0.8	14.6
Canada	2	31,600	1.8	0.3	14.0
Denmark	14	236,300	14.1	2.1	14.3
France	16	160,500	9.7	1.5	14.3
Germany	40	733,300	45.6	6.9	14.9
Italy	10	210,000	14.3	2.2	16.3
Japan	11	291,500	18.9	2.9	15.5
Netherlands	49	962,100	58.7	8.9	14.6
Norway	33	476,500	28.0	4.3	14.1
Portugal	0	0	0.0	0.0	12.0
Spain	5	36,700	1.9	0.3	12.7
Sweden	91	1,759,300	105.8	16.1	14.4
United Kingdom	258	5,033,640	306.9	46.8	14.6
Total	561	10,679,810	656.6	100.0	14.6

FROG BRAND

Sawyer's

NEOPRENE LATEX

protective

wear . . .

gives complete protection from

ABRASION & SNAGGING · OILS & GREASES · ACID & ALKALINE SOLUTIONS SALT WATER · NOT AFFECTED BY EXTREME HEAT OR COLD

The difference is in the fabric. Sawyer's exclusive "saturation-coating" process not only *coats* but thoroughly *impregnates* our top quality base fabrics with 100% DuPont Neoprene Latex. Our Frog Brand protective clothing is not only coated *inside and out* but all the way *through* . . . to give you the toughest, longest-lasting protective wear on the market. Furnished in suits (pants and jacket), long coats, unionalls, with buttons or snaps. Aprons designed for complete protection and comfort. Same styles in Rubberized or Oiled fabrics. Colors: Black or Yellow. Illustrated catalog and detailed price lists on request.

Illustrated above: ¾ length coat.

The H. M. SAWYER & SON CO.

Cambridge 41, Mass.

The most prominent factors would relate to:

1. The general economic framework.
2. The magnitude of the present tanker-construction program.
3. The probable ship completion and delivery rate.
4. The obsolescence rate.

Generally, a continuation of the present economic conditions has been accepted in this analysis. This would include a volume of military petroleum requirements for some type of peripheral war activity and an increase of 4 to 5 per cent per year in the world production of crude oil. In addition, the same relative rates of change both in pipe-line construction and tanker operating productivity as those of the past half century are implicit in the correlation formula.

Division of Construction

Less than 7 per cent of the present tanker construction program has been placed in United States shipyards while 47 per cent is being built in Great Britain and 16 per cent in Sweden. The present United States tanker construction program proportion is exceeded by the Netherlands' orders, 8.9 per cent, and equaled by the 6.9 per cent of the total program orders placed in western Germany's shipyards. Primarily responsible for this situation are the two factors of construction cost and operating cost differentials between United States tankers and those of foreign build and registry. Unless some incentive is made available to United States operators, there appears small likelihood that a large expansion in construction will occur in this country.

A comparison of vessel size and speed between current construction and present fleet is afforded in Fig. 1 and Table 2.

Only 11 per cent of the present construction program reflects tank ships which are smaller than a T-2 in carrying capacity while 22 per cent are equal to a T-2 and the remaining 67 per cent have greater performance capacity than a T-2.

Numerous interviews both with United States and British tanker owners having large construction orders in foreign yards developed the fact that delivery dates submitted by builders may be too optimistic. Instead, substantial agreement among those interviewed indicated that all shipyards outside those in the United States would probably deliver only 95 T-2 equivalent tank ships annually for the next few years. Estimates ranged from 86 to 104 T-2's. It is on the basis of this concensus and the magnitude of orders for dry-cargo shipping that foreign deliveries of tankers have been maximized at 95 T-2 equivalents per year. Probable levels of completions for the present program are as shown in Table 3.

With the anticipation of greater steel supply available for shipbuilding in the third quarter of 1952, it appears that the present tanker program in the United States yards will be completed by the end of 1953. For the lack of steel in the first half of 1952, it is also probable that total deliveries in the entire year may be less than the estimated 126.5 T-2 equivalent tank ships.

Perhaps the final major problem, obsolescence, will present the industry with its greatest difficulties (Fig. 2). The age of the present fleet is distributed as shown in Table 4.

Obviously, the tanker industry is presently confronted with the knowledge that 183 T-2 equivalents and 11.5 per cent of the world fleet are over 20 years of age. Within the next 5 years, 1952 through 1956, another 58 T-2 equivalent tankers will fall in this category for a total of 241 T-2's and 15 per cent of the present fleet. From 1957 through 1961 another 10 per cent of the present fleet will become over age. It is at that time, 1962, that the war-built tankers will begin to enter the 20-year age group. In the following quinquennium, 1962 through 1966, about 770 T-2 equivalents or nearly half, 48.5 per cent, of our present fleet will reach the "20 years and over" status. Thus the tanker industry must consider either the extensive repair or complete replacement of about one-quarter of the present fleet in the next decade and three-quarters of the current world fleet in the next 15 years.

This problem of obsolescence will become more intensified as the present construction program nears completion. Unit operating costs for wages, food, and fuel in a large, fast, modern tanker for long hauls are considerably below comparable costs for the older vessels. The compensating fixed costs of depreciation on lower construction outlay and insurance based on resale value for the older tankers may offset, in part, these technological advances in ship design.

The basic evidence presented in this analysis is that a tight tanker supply-demand balance will exist for the next 2 to 6 years. Unless a substantial expansion occurs in new construction or an extremely large effort is made in a program of extensive repairs for the older fleet before 1961, the tanker industry will then be faced with the severe impact of having to replace nearly three-quarters of its fleet in the 5 years 1962-1966.

Acknowledgment

Acknowledgment is made for the cooperation furnished by Esso Shipping Co.; Shell Petroleum Co., Ltd.; Overseas Tankship Corp.; and foreign and program divisions of PAD, and the Vessel Records Section of the Maritime Administration. The basic statistical compilations were assembled under the direction of J. Hunter McDowell of the Sun Oil Co. statistical research staff.

In cellar control gates...

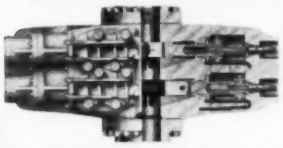
SHAFFER ALONE gives such complete selection

Bring your cellar control gate problems to Shaffer, because only Shaffer provides such a complete selection of equipment to meet varying requirements—and operator's preferences...

Hydraulic OPERATION

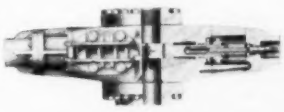
Rams are opened and closed by hydraulic fluid under pressure. Quick, convenient and readily adaptable to a wide range of control hook-ups. Shaffer Hydraulic Gates are widely used on modern drilling operations.

DOUBLE GATES



The Shaffer Hydraulic Double Cellar Control Gate provides *two* separate ram compartments—with hydraulically-operated rams—unitized into *one compact* body. Even in sizes as large as 13⅜" (12" Series 900) it requires only 30" overall height—smaller sizes even less!

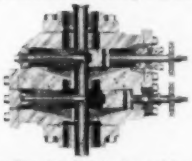
SINGLE GATES



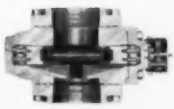
The Shaffer Hydraulic Single Cellar Control Gate can be used singly or with other Single or Double Hydraulic Gates to provide one—or multiple—ram compartments, as desired. Requires only 18½" overall height even in sizes as large as 13⅜" (12" Series 900)—smaller sizes even less!

Mechanical OPERATION

Rams are opened and closed by synchronized operating screws rotated by a compact motor drive—or rotated manually. Simple and compact, Shaffer Mechanical Gates are easy to install and give positive protection for today's drilling operations.



The Shaffer Mechanical Double Cellar Control Gate provides *two* separate ram compartments—with mechanically-operated rams—unitized into *one compact* body. Even in sizes as large as 13⅜" (12" Series 900) it requires only 28½" overall height—smaller sizes even less!



The Shaffer Mechanical Single Cellar Control Gate can be used singly or with other Single or Double Mechanical Gates to provide one—or multiple—ram compartments, as desired. Requires only 17⅜" overall height even in sizes as large as 13⅜" (12" Series 900)—smaller sizes even less!

AN ADDED ADVANTAGE—Ram Blocks and Ram Rubbers for Shaffer *Hydraulic* and *Mechanical* Gates are interchangeable, size for size. Saves on inventories, simplifies maintenance wherever both types of Gates are used!

See your nearest Shaffer representative for full details on the many unique advantages engineered into Shaffer Cellar Control Gates—or write direct!

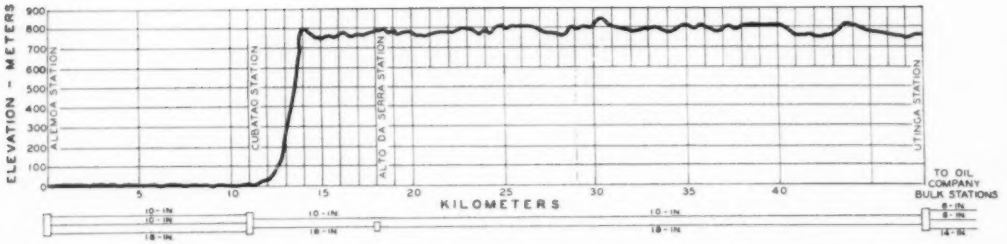
See pages 4525 to 4600 of your 1951 Composite Catalog. Write for your free copy of the new Shaffer Catalog.

SHAFFER

HIGH PRESSURE DRILLING AND CONTROL EQUIPMENT • FISHING TOOLS THAT EXCEL

SHAFFER TOOL WORKS, Brea, California • California Service Shops: Santa Fe Springs and Tait
HOUSTON, TEX. . . 4006 Navigation Blvd. • ODESSA, TEXAS, 1925 West Second Street
OKLAHOMA CITY, OKLAHOMA, Acme Oil Tool Company, 1001 S. E. 29th Street
CASPER, WYOMING, Shaffer Tool Works, Post Office Box 1788
EXPORT SALES OFFICE: Shaffer Tool Works, 500 Fifth Avenue, New York, N. Y., U.S.A.

28 years OF OIL TOOL LEADERSHIP



Elevation profile of product pipe line reflecting difficulties encountered in construction and operation.

Brazilian Products Pipe Line Starts Operation From Santos to Interior

Steep slopes necessitated unusual construction methods

GASOLINE arrived in Sao Paulo, Brazil, by pipe line on October 19, 1951. It marked the beginning of transporting petroleum products from the port of Santos to the metropolis of Sao Paulo and thence to the interior of Brazil.

A steep coastal escarpment about 7 miles from Santos has been a handicap to the movement of vast quantities of exports and imports over a modern highway and two railroads into the interior. The pipe-line system will not only facilitate the movement of petroleum products and relieve the congestion on the highway and the railroads, but it will also provide a cheaper mode of transportation.

For the present this system will transport gasolines, kerosine, diesel oil, and heavy fuel oil imported from Venezuela and Trinidad. It begins at the port of Santos and ends at the bulk stations of the various oil companies in the city of Sao Paulo. The main-line distance between Santos and the pipe-line terminal at Sao Paulo is approximately 30 miles. Beyond the terminal is a system of secondary lines that connect the respective bulk stations of the privately owned oil-distributing companies.

Serra Do Mar station of new product line in Brazil.

The clear products system consists of two parallel 10-in. lines for approximately the first 7 miles (leading to the first high-pressure pumping station) and thence approximately 23 miles of single 10-in. that ends at the pipe-line terminal in Sao Paulo. Products received through the two 10-in. lines at the first high-pressure station may either go into storage or be pumped beyond. Beyond the terminal (about 4.5 miles) a secondary system of two 6-in. lines has been designed to deliver clear products to the bulk stations. The purpose of the two 10-in. lines at the beginning and the two 6-in. lines beyond the terminal is to transport the kerosine and diesel oil and to move the gasolines through separate systems where more than one party is involved in measurements.

Pumping-Station Heaters

A single 18-in. line is being constructed from Santos to Sao Paulo for the transportation of the heavy viscous fuel oil. Heaters are provided at the pumping stations for heating the fuel oil when required. A 14-in. line (about 4.5 miles) will be built beyond the terminal to connect the respective bulk stations for delivering the fuel oil to the oil-distributing companies.

The pipe-line system will be owned and operated by a pipe-line department of the Estrada de Ferro Santos A'Jundiai Railroad which carries most of the traffic between Santos and Sao Paulo. The railroad is owned by the Brazilian Government. The pipe line has been financed by Brazilian funds of both government and private capital.

Stations.—There are two high-pressure (1,500 psi.) and two moderate and low-pressure booster stations on the system. Alamoa pumping station at the beginning receives heavy fuel oil from the tanks of the Cia. Docas (Santos) and pumps it only 7 miles to Cubatao, the first high-pressure pumping station at the foot of the Serra do Mar. This station consists of three electrical motor-driven, port-

able-type Gaso pumps. The pumping capacity at present is not to exceed 20,000 bbl. per day at 700 p.s.i. The clear products are pumped by the Cia. Docas from its receiving tanks on the island of Barnabe in the harbor of Santos to the receiving and measuring tanks of the pipe-line company at Cubatao.

The principal pumping station on the system is at Cubatao, near the foot of the steep coastal escarpment. A part of this pumping station is a small tank farm for receiving, measuring, and testing the petroleum products.

Cubatao pumps the clear products through the 10-in. all the way to the terminal (Utinga) at Sao Paulo. The fuel oil is pumped to a second relay station, known as Alto da Serra, about 4 miles beyond the top of the Serra do Mar. The second pumping station relays the heavy fuel oil through about 20 miles to Utinga terminal. At Utinga terminal there is a pumping station consisting of low-pressure, motor-driven centrifugals for pumping clear products to the bulk stations and portable-type Gaso pumps for pumping the heavy fuel oil.

At Cubatao pumping station four Worthington triplex pumps (4½ by 18) and two Aldrich variable-stroke pumps are used. The pumps are driven by General Electric motors. The pumping capacity is divided equally between the heavy fuel oil and clear products. All of this pumping machinery is designed for 1,500 psi. The static head, due to the Serra do Mar, varies from 800 psi. for the light products to 1,040 for the heavy fuel oil. A further reason for the high pressure is the friction loss that will be encountered in pumping the heavy viscous fuel oil. All of the Worthington triplex pumps are identical. The capacity of the gasoline pumps will be 20,000 bbl. per day each, and that of the heavy fuel-oil pumps will be 15,000 bbl. per day each.

The gasoline pumps will run at 81 r.p.m., and the fuel oil pumps at 61 r.p.m. The difference in the speed and capacity of the pumps is obtained by using different speed motors. At Alto da Serra the same equipment, except only half of that used at Cubatao, is being installed because only the heavy fuel oil will be pumped at this station.

The reasons for chosing reciprocating pumps at Cubatao and Alto da Serra pumping stations were: (1) the pumping of the heavy viscous fuel oil required the use of reciprocating pumps; (2) this led to the use of the same type of pumps for the clear products for the purpose of having identical equipment that meant interchangeability of reserve units and the same spare parts; (3) on account of the high static head on Cubatao pumping station, the flexibility in the capacity of centrifugal pumps is very limited. The purposes of the Aldrich (3,800-bbl. per day) variable-stroke pumps are: (1) to provide flexibility in capacity until change in plungers in Worthington triplex pumps is justified; (2) to start streams moving against high pressure, especially in the case of the heavy viscous fuel oil; (3) to "top out" tanks in making deliveries to the terminal or to the bulk stations; (4) to keep the streams moving through the pipe lines at a low continuous rate instead of shutting down; and (5) to expel scrapers from scraper traps.

The ultimate capacity of the 10-in. clear products system will be 45,000 to 60,000 bbl. per day, and that of the 18-in. line for heavy fuel oil will be 30,000 to 35,000 bbl. per day.

Although this pipe-line system is comparatively short, the terrain is unusual and difficult for pipe-line construction. From Santos to Sao Paulo it is characterized by a swamp, a steel coastal escarpment, lakes and hills, and suburban real-estate developments.

From Alamoa to the approach of the Serra do Mar, about 10 km., the land is typical of a delta—a meandering river with numerous branches, lagoons, and swamps. The water table varies from 1 to 2 ft. below ground. The land is not firm and for this reason the railroad and the highways are built on earthen fills. The first

(Continued on page 290)

Want this job to STAND UP?

...use TRANSITE PIPE for corrosion-resistant salt water disposal lines!

NO NEED to run up overhead through costly replacement of your salt water disposal lines. Just lay Transite* Pressure Pipe . . . the pipe that stands up under corrosive attacks where ordinary pipe materials fail.

That's because Transite Pipe is made of an asbestos, cement and silica composition, by a special Johns-Manville process that imparts high corrosion resistance all the way through. Transite resists the destructive action of salt water on the inside—as well as corrosive soil on the outside. Moreover, this strong, durable pipe withstands all normal service temperatures—will not deform in use.

In addition to its long life, Transite Pipe offers these other money-saving advantages: (1) economical handling—most sizes can be unloaded and lowered into the trench without mechanical handling equipment; (2) rapid assembly, because of Transite's factory-made Simplex Couplings; (3) complete adaptability to oil field requirements—assured by a full range of pipe sizes, plus fittings for every need.

For further information write Johns-Manville, Box 290, New York 16, N. Y.

JM

*Reg. U. S. Pat. Off.

Johns-Manville TRANSITE PRESSURE PIPE

STILL YOUR BEST BUY...

Where pipes meet permanently...

W-S FORGED FITTINGS

in CARBON, ALLOY and STAINLESS STEELS

. . . Still your best buy, because W-S longer service life and increased dependability give that permanency which will lower maintenance costs . . . They are drop forged.

Basic materials are selected from a wide choice of carbon, stainless and alloy steels and then subjected to the most exacting metallurgical controls from melt to bar. Through these precautions and subsequent precision machining operations, W-S assures the utmost in accuracy of finish, perfection of threads, sockets, angles and concentricity. All W-S Fittings, — Screwed and Socket Welding Types, — are finally instrument inspected.

W-S Bulletin A3-50 details the Carbon Steel Line. Bulletin S-1 is devoted to Stainless and the Alloys. W-S will gladly furnish information on the new FEATHERLITE Fittings — a recent big step in a wide range of services. Write today for the specific bulletin you desire.

Sold Through Leading Distributors

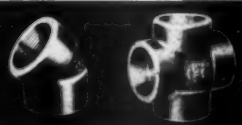
9-L-2

DISTRIBUTOR PRODUCTS DIVISION

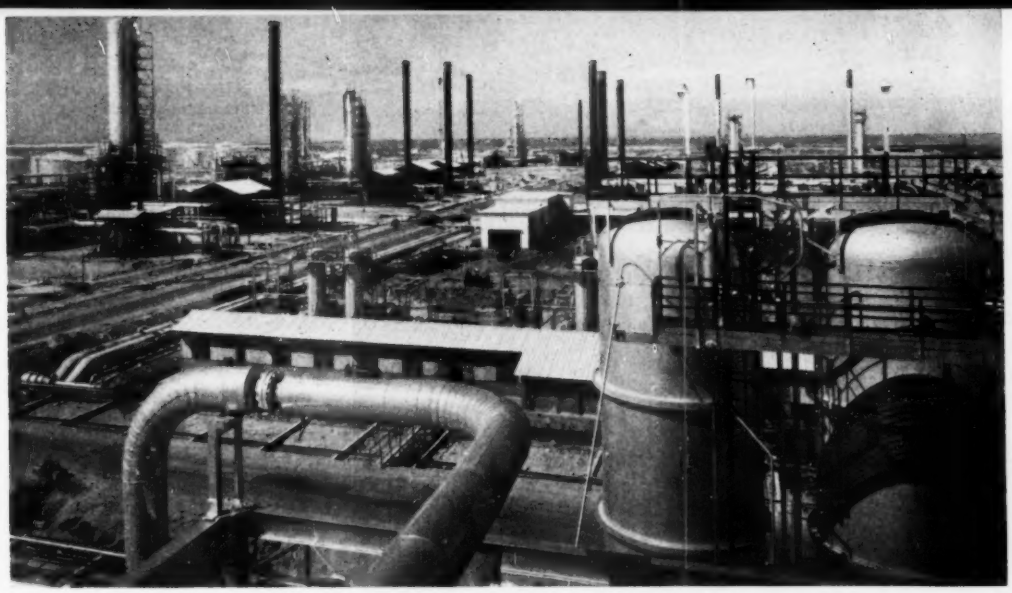
WATSON-STILLMAN

Established 1848

ROSELLE, NEW JERSEY



Designers and Manufacturers of Forged Steel Fittings, Valves, Wire Rope Shears, Hand Pumps, Jacks, Pipe Benders and Hydraulic Equipment



Partial view of Shell Cardon refinery, taken from clay contact plant.

Expansion at Cardon will make it

South America's Biggest Refinery

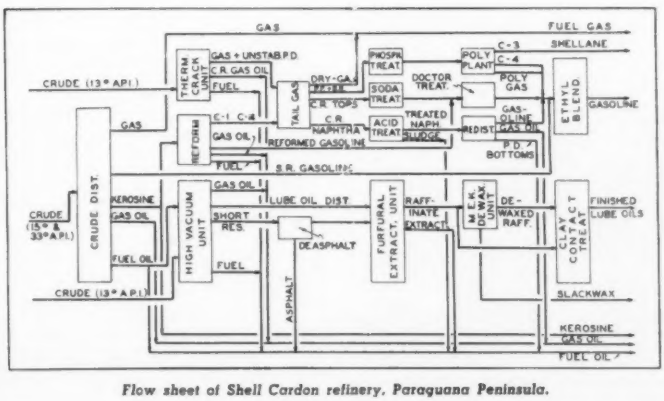
Cardon, when completed, will have a capacity of 170,000 bbl. daily, and ~ lubes capacity of 100,000 tons yearly

IN the postwar years the Royal Dutch-Shell Group has embarked on a $200,000,000 undertaking in the construction of a refinery on the Peninsula of Paraguana in northern Venezuela. This undertaking is in line with the policy of the Venezuelan Government to have more crude oil refined in Venezuela and has greatly contributed to the increase in recent years of the country's own refining capacity.

The refinery, intake of which is presently about 83,000 bbl. per day, is already one of the outstanding refineries in South America, but further expansion to a capacity of 170,000 bbl. per day is under way. When this is complete, Cardon will be by a considerable margin the biggest and most complete refinery in Latin America. Added importance is given to this refinery by the fact that it contains a large and up-to-date plant for the manufacture of a full range of lubricating oils, which plant consists of four separate units capable of producing as a whole approximately 100,000 tons of lubricants a year.

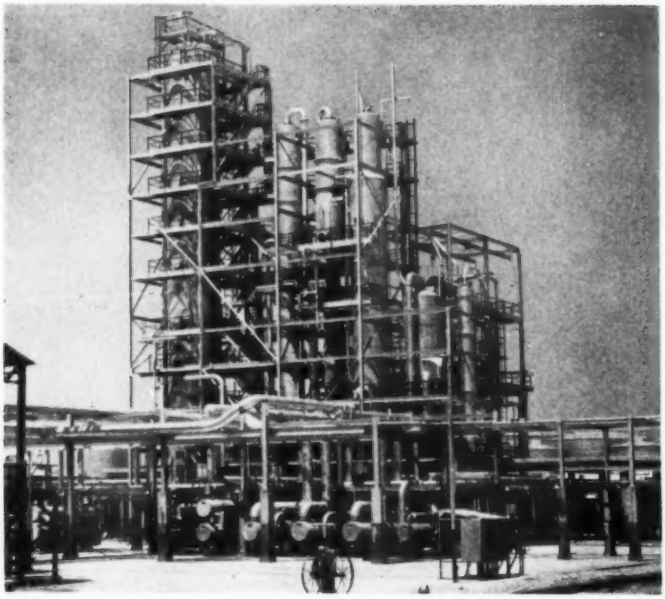
Despite the disadvantages of the waterless desert conditions prevailing on the Paraguana Peninsula, a site of some 3,200 acres was chosen for the refinery in the southwest corner of the peninsula because it is the nearest deep-sea water site to the Maracaibo Lake oil fields, and the 50-ft. cliffs forming the shore line provide useful shelter to the harbor from the northeast wind which blows across the peninsula with considerable force for most of the year.

The delivery of crude from Shell's oil fields in western Venezuela to the refinery is handled by shallow-draft lake tankers. Work is also nearing completion on a 30-in. pipe line connecting the oil-field terminal of Palmarejo, north of Maracaibo, to the Cardon refinery. This line, which is jointly owned by the Shell, Texas, and Mene Grande Oil companies (Shell having an 89 per cent interest), will have a total length of 163 miles, including two submarine crossings, one at the Gulf of Coro and the other across the neck of the Lake of Maracaibo.



Flow sheet of Shell Cardon refinery, Paraguana Peninsula.

Facilities. — Owing to the isolated



Furfural extraction unit of the lubricating-oil plant.

location of the site, there was, of course, a complete lack of utilities and facilities which are necessary for the operation of a refinery, and for the maintenance of its employes and their families. Therefore, not only the actual plants, tank farms, and pipe lines had to be built, but it was also necessary to construct harbor facilities, power plants, water systems, hospitals, schools, dwellings, and all general social facilities. The utilities and social facilities combined have cost as much to construct as the refinery itself.

Speedy construction.—Notwithstanding the difficulties of carrying out construction of this magnitude in a desert area, complicated by the difficulties encountered in the immediate postwar years with the purchase and transportation of the necessary materials, the first plant, crude unit No. 1, was put on stream (in February 1949) less than 4 years from the date the first party set foot on the site. Within a year thereafter 11 more units followed, namely the high-vacuum plant, two thermal cracking plants (Dubbs), a redistillation unit, a reformer, a gas-separation plant, a phosphate treater, a polymerization plant, a doctor-treating plant, a soda treater, and an acid treater. By the end of 1949, crude intake was at 47,000 bbl. per day, by end of 1950 over 70,000 bbl. per day, and by early 1951 approximately 80,000 bbl. per day.

Lube-Oil Plant

Apart from all the aforementioned units, it was decided to build a 100,000-ton per year plant for the manufacture of lube oil. This plant, when completed by the end of this year, will be the largest such plant in Latin America. The project, which was started in September 1949, entails the construction of four separate units, in addition to blending and filling facilities and some 50 storage tanks. The units are: a propane deasphalting unit, a furfural extraction plant, an M.E.K. dewaxing plant, and a clay contact unit. The existing 17,000-bbl. per day high-vacuum unit produces lube-oil distillates from the residue which it receives from the crude-oil units and from Tia Juana crude delivered direct from storage.

Design and Construction

Design of the plants was carried out as follows:

Crude unit No. 1, high vacuum, gas-separation plant, doctor treater, redistillation unit, lube-oil plants, and crude unit No. 2, designed by Lummus Co.

Cracking plants Nos. 1 and 2, reforming plant, and polymerization plant, designed by Universal Oil Products Co.

Acid treater, phosphate treater, and soda treater, designed by N. V. de Bataafsche Petroleum Maatschappij, The Hague.

Lummus Co. contracted the erection of all these plants, and has therefore been active on the site since October 1946.

Additions

In June 1951, the foundations of a second crude unit were laid. This unit will have a capacity of 52,500 bbl. per day and will, together with modifications to increase the capacity of the first crude unit and the conversion of the redistillation unit into a crude unit, raise the capacity of the refinery to 170,000 bbl. per day by the end of 1952 or shortly thereafter.

Products

The flow scheme of the refinery shows a straightforward processing arrangement. It will be noted that treatment of crude for maximum light ends is not a feature of the refinery but rather that stress is laid on a general balance of all products to meet the general world market demand pattern into which this refinery has been designed to fit, and in which fuel oil is a very important factor.

The crude units are mostly fed with the "light" crudes from Shell's Cretaceous fields in La Paz (33°-34° A.P.I.), but they also take a certain amount of the heavier Lagunillas (15°-16° A.P.I.) crude for lube-oil purposes. The two 12,500-bbl. per day cracking plants are designed for cracking heavy crude (around 13° A.P.I.) which comes from the east coast of Lake Maracaibo, mostly from Bachaquero, while the 9,000-bbl. per day reforming unit converts lighter oils and naphthas into gasoline of high-octane number to be used as component of motor gasoline.

The gas-separation plant receives all the cracked and reformed gases and light distillates and separates them into gas, propane and butane

View of the industrial laboratory of Shell Cardon refinery.

fractions, cracked gasoline, and naphthas. Propane and butane fractions are fed to the phosphate treater for mercaptan removal, and are subsequently converted by polymerization in the poly plant into a gasoline component.

The treating plants take care of the purification and sweetening of the other products from the tail gas and of the reformed gasoline. The lube-oil plant receives its feed stock directly from the adjacent high-vacuum plant. The lube-oil distillates originating from the Lagunillas and Tia Juana crudes pass through the furfural plant and the clay contact unit, while those from the La Paz crude require dewaxing.

Residue from the La Paz crude processed in the lube-oil plant first has to be deasphalted before it is converted into finished bright stock. Final lube-oil products will be of various grades including bright stock.

Approximate gross yields of products is presently of the following order:

	Per cent
Motor gasoline (regular and premium grades)	23
Kerosine	4
Gas oil-diesel fuel	12
Fuel oil	54
Fuel gas (inc. Shellane)	4
Lube-oil bright stock, etc.	3

Liquid propane in cylinders is also supplied for the Venezuelan market.

Storage.—At the south side of the plants is a crude-storage tank farm with a total capacity of 2,200,000 bbl. At the north side some 50 products tanks are situated for the storage of all fuel oil, gasoline, kerosine, gas and diesel oil, unfinished products, etc., with a total storage capacity now of 3,000,000 bbl. Moreover, the lube-oil plant has a storage capacity of 750,000 bbl.

Harbor.—Pipe lines lead to the harbor where two reinforced-concrete combined oil-and-cargo jetties can accommodate four big ocean tankers and four shallow-draft lake vessels at the same time. Each jetty is 1,500 ft. long and carries the lines below the monolithic concrete decking of the platforms. In addition to these, a small coastal jetty was built, which will shortly be rebuilt and extended so as to make it suitable for the loading of the biggest size of tankers.

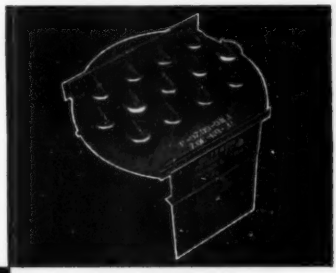
Electrification.—Among the utilities which had to be constructed was an electric power plant. As the refinery equipment is run mainly by electricity, the principal purpose of the power plant is to provide power for the industrial area, but the residential area naturally adds to the load. It has four turbines of about 10,000 hp. capacity each and four generators with a total capacity of 30,000 kw. More than 2,000 km. of cable and electric wires was laid. The present rate of consumption is about 7,500,000 kw.-hr. per month of which the industrial area takes 95 per cent.

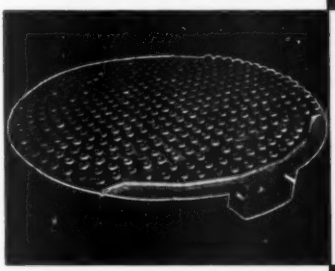
A steam-generating plant consisting at present of three high-pressure boilers (500 psi.) provides the steam for the power plant, and four low-pressure boilers (260 psi.) supply steam to the industrial area. With the completion of the fourth high-pressure boiler, the total installed capacity will be about 400,000 kg. per hour.

Water supply.—For the first few years virtually all the fresh water had to be imported by tankers. Later on some temporary salt-water distilling capacity was installed to provide drinking water, leaving industrial water still to be brought by tanker. Finally a project was carried out jointly with the Venezuelan Government and Creole Petroleum Corp. to lay a 30-34-in. gravity line about 62 miles long from springs and wells on the edge of a mountain range on the mainland. The line follows along the isthmus to Cardon refinery, Creole's Amuay refinery, and the adjacent township of Punto Fijo. The line has a capacity of 225,000 bbl. of water per day.

In the refinery itself, sea water is used for cooling in most cases. To supply this cooling water, a salt-water pump house was constructed at the sea shore, in which were installed five centrifugal pumps with a capacity of 6,000 cu. m. per hour each. In

GLITSCH TRAYS *for* EVERY PURPOSE!





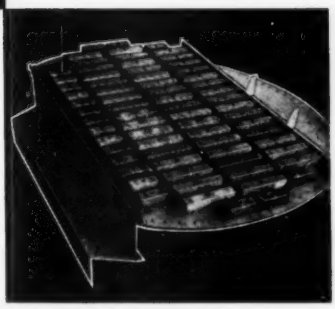
▲GLITSCH Bubble Tray with wedge type bubble cap holddowns for 2'-6" diameter I. D. Tower, and is made from carbon steel material.

◀GLITSCH BubbleTray with de-pressed or streamlined caps is 16'-6" in diameter, and is made from 12% chrome type 410 stainless steel.

▼GLITSCH Bubble Tray with rectangular bubble caps is 9'-0" diameter, and made from 18-8 type 304 stainless steel.

GLITSCH "Truss-Type" Bubble Trays can be utilized for any process requirement with respect to tray size, layout and type of flow, shape and type of downcomer, weirs, wells, risers, bubble caps—and, more recently, integrated vessel units.

Fritz W. Glitsch & Sons, Inc. will mechanically engineer and fabricate a GLITSCH "Truss-Type" Bubble Tray to your individual process requirements.



Glitsch

FRITZ W. GLITSCH & SONS, Inc.
BOX 6227 • DALLAS 2
New York Chicago
Houston Cleveland
Tulsa Los Angeles

"TRUSS-TYPE" BUBBLE TRAYS • BUBBLE CAPS • TOWERS • TOWER INTERNALS

addition to the cooling-water pumps, this same pump house contains three fire-fighting pumps of 500 cu. m. per hour each.

Self-contained township.—The residential area constructed by Shell coincident with construction of the refinery consists of about 1,500 modern houses of various types and sizes for staff and labor. Churches, schools, clubs, sports fields, shops, a clinic and hospital, large open-air cinema, beauty shop, restaurants, and a huge commissary all form part of this modern town. It is noteworthy that right from the beginning all dwellings were permanent constructions and that no temporary houses were ever used; naturally, in the earlier stages, many permanent buildings were occupied for very different functions, such as use of schools for offices, dwellings for commissary, etc., but nearly all buildings are now being used for their originally designed purposes. The township is now inhabited by a colony of around 6,000 people, including, of course, wives and children of the employes.

Brazilian Products Line

(Continued from page 285)

firm ground is encountered at the foot of the Serra do Mar, approached between Km. 10 and Km. 12. The swamp land between Santos and the foot of the Serra do Mar is planted in bananas and it is crisscrossed with numerous narrow, shallow drainage ditches.

At Km. 11.5 the coastal escarpment, known as the Serra do Mar, rises abruptly as a steep flank of the plateau. In 3 km., between 11.6 and 14.6, it rises nearly 800 m. This steep slope of the Serra do Mar is covered with a heavy growth of semitropical vegetation. Because of the nature of the soil and on account of the heavy rainfall, the slope is subject to landslides. The soil is clay and there is no rock.

Beyond the top of the Serra do Mar a rough terrain is characterized by a succession of hills that extends as far as Km. 30. The valleys in this area are filled with artificial lakes that have resulted from damming the water shed. These lakes serve as the water reservoirs for the large hydroelectrical plant at the foot of the Serra do Mar. Beyond Km. 30 the rough terrain merges into undulating countryside. The hilly terrain for the first 4 km. beyond the top of the Serra do Mar is covered with small trees and brush. Beyond Km. 20 the countryside is bare. In the entire length of the pipe line, there is practically no agriculture except for the banana plantations in the delta and there are only a few fences.

Unusual Design

Unusual designs and construction methods have been employed for the lines on the steep slope of the Serra do Mar. Because of the conditions that have been described above, it was necessary to build a narrow-gage cable railway not only for the construction, but also the operation of the pipe lines. A hoist on the top of the mountain will operate the cable car. The 10-in. and 18-in. line will be anchored and supported aboveground with provision to compensate for contraction and expansion by offset bends. The lines will lie adjacent to the cable railway. The right-of-way on the slope of the Serra will be surfaced with asphalt and rock to carry off the heavy rainfall and to prevent earth slides and erosion. Concrete drainage ditches are provided on each side of the surfaced right-of-way to carry off drainage water.

The engineering plans were prepared by Williams Bros. Co. and the purchasing of the materials, except for the 18-in. pipe procured in Germany, was done by the same organization as agents for the Estrada de Ferro Santos A'Jundiai. All of the materials (except the 18-in. pipe) procured outside of Brazil were purchased in the United States. The construction contractor is Companhia Tecnica Internacional do Brasil. The consulting engineer is William G. Heltzel. The project has been carried out under the direction of Dr. Renato Feio, administrator of the Estrada de Ferro Santos A'Jundiai, and Col. Arthur Levy, chief of the pipe-line commission.

There's a good way to get acquainted with

HARRISBURG COUPLINGS

too!

If you haven't yet "made the acquaintance" of *Harrisburg Seamless Steel Pipe Couplings* in your business . . . isn't it about time you got to know the superior features of this fine product?

It's easy. All you have to do is call in the Harrisburg distributor nearest you, and let him show you samples . . . go over these couplings point by point . . . and quote you prices and delivery. Then *you* decide!

Among other things, *Harrisburg Couplings* are made to A.P.I. and A.I.S.I. specifications . . . in A.P.I. casing, A.P.I. line, drive, water well, and other types. Ask your Harrisburg distributor. Or write the factory for full details.

Consult our Oil Country Distributors or write Harrisburg.

SEE OUR CATALOG IN THE COMPOSITE CATALOG

HOUSTON 1
Henry H. Paris Distributor, Inc.
LOS ANGELES 58
Howard Supply Company
TULSA 1
W. C. Norris Manufacturer, Inc.

HARRISBURG STEEL CORPORATION
Harrisburg 6, Pennsylvania

Custom-Built Quality Products in Quantity
98 YEARS IN PENNSYLVANIA'S CAPITAL

AMERICA'S LARGEST LINE OF DRY CHEMICAL FIRE EQUIPMENT!

ONLY *Safety First* OFFERS...

Fast Acting, Highly Effective Dry Chemical Fire Extinguishers From

2½ lbs. to 30 lbs.

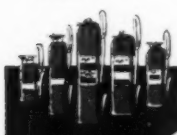
The exclusive Safe-T-Meter gauge tells you at a glance it's **Ready To Go!**

A LEADER IN DESIGN AND ENGINEERING

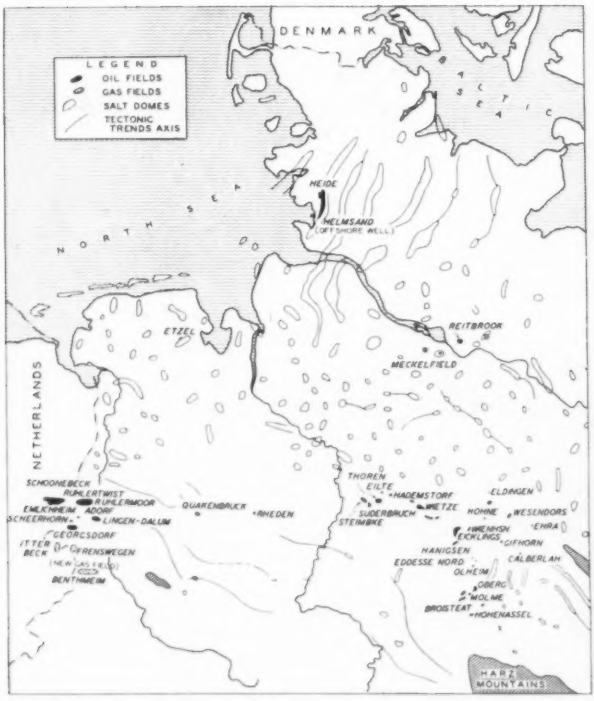
Safety First, a leader in design and engineering of fire fighting equipment, still leads the field with the largest, most versatile line of fast-acting, highly effective Hand Portable Dry Chemical Fire Extinguishers! This complete line of 9 powerful, sturdily-built sizes ranging from 2½ to 30 lbs., offers an extinguisher for any price or need. Available in the regular industrial type or the revolutionary pressurized Safe-T-Meter model with the exclusive visual gauge for on-the-spot inspection.

NEW RECHARGE CYLINDER MAKES PRESSURIZING EASY!

Just follow simple directions on recharge cylinder label... no tools or technical knowledge is needed. When cylinder is expended return to your Safe-T-Meter dealer for replacement.



Safety First PRODUCTS CORP., ELMSFORD, N.Y.



Map of Western Europe reflecting steady expansion in oil and gas operations since close of World War II.

Exploration test of Deutsche Erdol AG near Bergen (Upper Bavaria).

More German Crude From Nonsalt-Dome Structures

German production this year of about 10 million barrels is only a third of the nation's demand

by Alfred M. Stahmer*

WHILE before World War II practically 100 per cent of the German indigenous crude-oil production came from deposits situated on the top or on the flanks of salt domes in northwestern Germany, in the autumn of this year the salt-dome fields participated with no more than 41.4 per cent. The bulk, namely 58.6 per cent, was produced from anticlinal or—to a very minor extent—from graben-fault deposits. For the future it can be foreseen that the percentage of salt-dome field crude will further decline against a growing part of oil from other beds.

This development began when in 1942 the first oil well came in on the fault-block structure of Lingen with which the new Emsland oil province was opened. All further exploration in the Emsland was successfully concentrated on nonsalt-dome prospects namely anticlines and—in the case of Scheerhorn—a sort of monocline unconformity, which may be interpreted as a stratigraphic trap.

While things in northwestern Germany went this way, the latest drilling results in the sedimentary areas of southwestern and southern Germany, namely the Rhine Valley graben and the Molasse basin between the Danube River and the Alps, where salt elevations are lacking at all, gave encouragement to exploration activities which one day may possibly lead to the development of a new oil province in southern Germany. Up until now the two small fields, Forst-Weiher and Weingarten-Werrabronn near Bruchsal in Baden, producing about 3,500 bbl. monthly are the sole oil sources in the South.

Suderbruch and Eldingen

In the first two Hanoverian fields on intermediate structures, Suderbruch and Eldingen, which were discovered in 1949, a considerable extension of the producing area could be achieved. In Suderbruch besides the Jurassic Cornbrash sandstone (found at a depth of 6,790-6,825 ft.), which is the main oil source, a further pay was discovered in the Valendis (Lower Cretaceous) at an average depth of 3,890 ft. Furthermore the Gigas beds of the Malm (average depth 5,250 ft.) proved to be oil bearing. In October 1951 Suderbruch produced about 75,000 bbl. from 25 wells.

In the development of Eldingen field near Celle difficulties arose through the block character of the structure and the fact that a small upper portion of the pay sand (Liassic) is oil impregnated while the lower portion has salt water only. Nevertheless Eldingen gives a prosperous outlook; 12 wells came in during the last 2 years, delivering in September 1951 more than 30,000 bbl. of crude of good quality (40 per cent light products). The distance between the wells is about 1,300 ft.

*Hamburg, Germany

Hohne

The heretofore single oil-field discovery of 1951 was made at the beginning of the year at Hohne, south of Eldingen. In the meantime four wells could be put into production at depths between 5,500 and 6,200 ft., delivering in September about 11,000 bbl. of crude from two horizons, the Liassic and the Rhaetic (Triassic). A fifth well came in toward the end of October with an initial flow of 85 cu. m. through a 12-mm. choke. The Liassic sandstone has a thickness of 65 to 90 ft., the two small Rhaetic horizons of 10 and 33 ft. respectively.

Emsland

An outstanding Emsland extension was the discovery of the Wealden in the western part of Georgsdorf field as a second pay. Hitherto the Bentheim (Lower Cretaceous) only had been producing. The well, No. 231, for the first time flowed heavy Wealden crude in Georgsdorf from a depth of 3,100 ft. at an initial rate of 25 cu. m. daily.

New Gas Fields

In the immediate vicinity of the Dutch border in 1951 two gas deposits were discovered on the joint concessions of C. Deilmann, Gewerkschaft Elwerath, Preussag and Wintershall AG. Both proved to be productive on the Netherlands side, too. The Itterbeck gas well corresponds with the Dutch well Tubbergen 4 and the gas find of Frenswegen near Nordhorn town with the nearby discovery of Denekamp in the Netherlands. In Frenswegen a test gave 75,000 cu.m. natural gas daily from the Zechstein (at a depth of 6,300 ft).

It is anticipated that the total German oil production this year will amount to about 10 million barrels. This is nearly one-third of what the country needs to cover its oil demands.

Exploration Gets Results In Saudi Arabia

(Continued from page 212)

Productive area may be about 12 miles long and 8 miles wide, but subsurface structure not yet clearly delineated.

Oil zone: "D" member (porous limestone) of the Upper Jurassic Arab zone. Depth to top of potential producing formation is about 6,200 ft.

Gravity: About 33° A.P.I.

Number of wells: Seven, of which six are capable of producing; one remains to be completed.

Tools: No strings operating in September 1951.

Uthmaniyah.—Structure: Irregular dome or brachyanticline determined by structure drilling and confirmed by a subsequent gravity-meter survey. Discovery well drilled in 1951. Subsurface structure not yet delineated; producing area not proved, but to date it is known to be 10 miles long and 2 miles wide.

Oil zone: "D" member (porous limestone) of the Upper Jurassic Arab zone. Depth to top of potential producing formation is about 6,500 ft.

Gravity: 33.5° A.P.I.

Number of wells: In September 1951, three capable of producing but shut in, two drilling.

Tools: Two strings operating in September 1951.

Safaniya.—Structure: Dome or brachyanticline determined by a gravity-meter survey supplemented by structure drilling and seismic mapping. Discovery well drilled in 1951. Subsurface structure not yet delineated.

Oil zone: Middle Cretaceous sands about 5,000 ft.

Gravity: 27° A.P.I.

Number of wells: In September 1951, two capable of producing but shut in.

Tools: Two strings operating in September 1951.

A considerable number of articles has been published in back issues of **The Oil and Gas Journal** regarding Aramco's operations in Saudi Arabia. In addition, the reader's attention is directed to the following books or periodicals in case he is interested:

1. Review of Middle East Oil, Petroleum Times, London, June 1948.

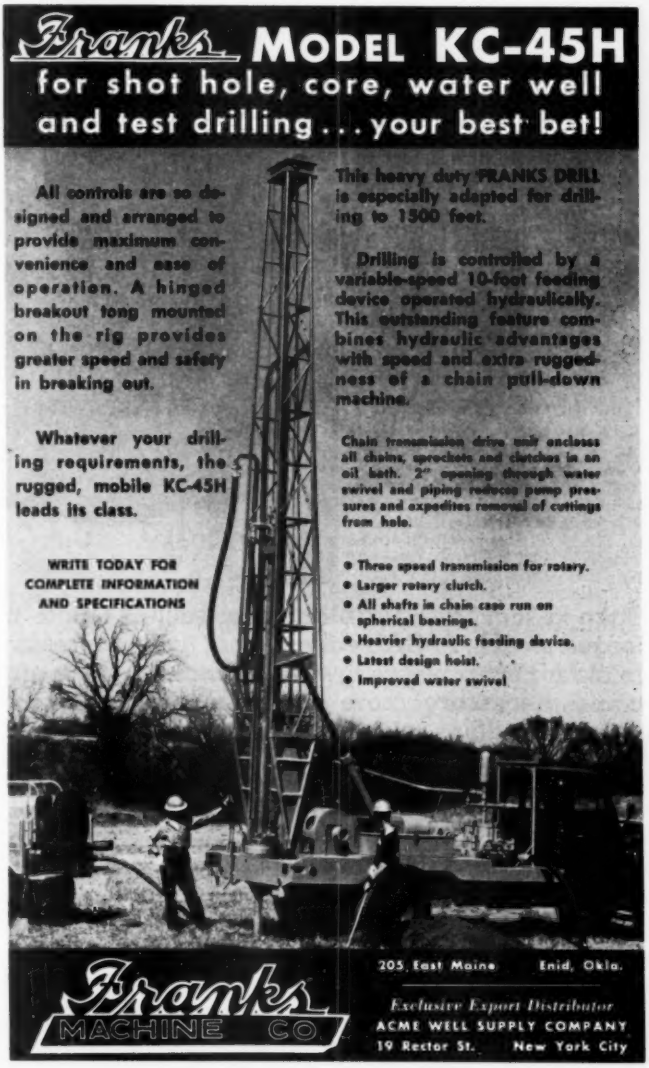
2. Kerr, R. C., Middle East and Adjacent Countries, American Association of Petroleum Geologists Bulletin, July 1951.

3. Pratt, W. E., and Good, D., World Geography of Petroleum, American Geographical Society Special Publication No. 31, Princeton University Press, 1951. (Part 9: "Saudi Arabia and Bahrein" by Max Steineke and M. P. Yackel, pages 203-229).

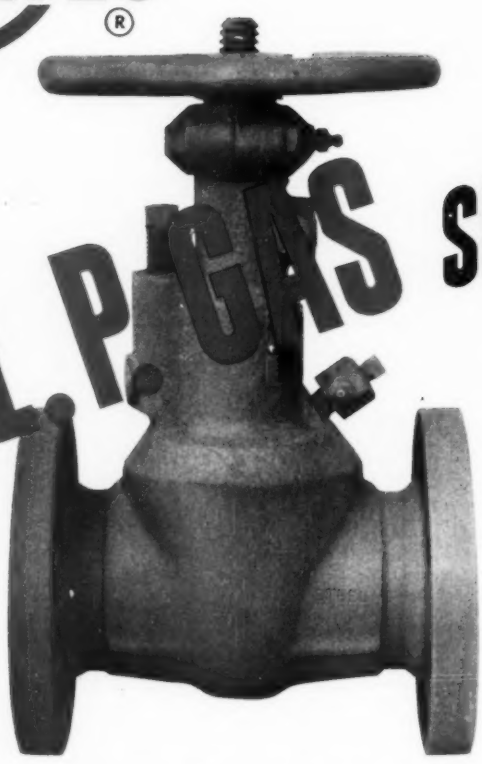
4. Van Tuyl, F. M., and Levings, W. S., Review of Petroleum Geology 1946, Colorado School of Miens Quarterly, July 1947.

SAUDI ARABIAN FIELDS—AVERAGE DAILY PRODUCTION

	1950 First 9 months	1951 First 9 months	Sept. 1950	Sept 1951
Dammam	92,400	87,643	97,500	84,972
Abqaiq	415,200	487,593	486,600	596,342
Qatif	12,000	18,531	10,850	20,687
Ain Dar	0	132,619	0	146,066
Total			594,950	848,067


Franks MODEL KC-45H
for shot hole, core, water well and test drilling... your best bet!
All controls are so designed and arranged to provide maximum convenience and ease of operation. A hinged breakout tong mounted on the rig provides greater speed and safety in breaking out.
Whatever your drilling requirements, the rugged, mobile KC-45H leads its class.
WRITE TODAY FOR COMPLETE INFORMATION AND SPECIFICATIONS
This heavy duty FRANKS DRILL is especially adapted for drilling to 1500 feet.
Drilling is controlled by a variable-speed 10-foot feeding device operated hydraulically. This outstanding feature combines hydraulic advantages with speed and extra ruggedness of a chain pull-down machine.
Chain transmission drive unit encloses all chains, sprockets and clutches in an oil bath. 2" opening through water swivel and piping reduces pump pressures and expedites removal of cuttings from hole.
• Three speed transmission for rotary.
• Larger rotary clutch.
• All shafts in chain case run on spherical bearings.
• Heavier hydraulic feeding device.
• Latest design hoist.
• Improved water swivel
Franks MACHINE CO
205 East Maine Enid, Okla.
Exclusive Export Distributor
ACME WELL SUPPLY COMPANY
19 Rector St. New York City

ORBIT VALVES®



FOR L. P. GAS SERVICE

Take a look at new plant construction—note the increased use of ORBIT forged steel L. P. GAS valves, from the compressors to the loading racks. And in older plants where lower cost maintenance and dependable operation becomes necessary, more and more plant superintendents are replacing old worn-out valves with ORBIT forged steel L. P. GAS valves.

ORBIT'S Friction Free resilient seating principle is a progressive approach to solving most valve problems.

Branches

HOUSTON, TEXAS
407 Velasco
(Serving the Gulf Coast)
ODESSA, TEXAS
Starr Warehouse
(Serving West Texas)
CASPER, WYOMING
The Great Western Co.
(Serving the Rocky Mountain States and Canada)

Orbit Valves **are Stocked by Your Supply Store**

ORBIT VALVE CO.
P. O. BOX 699 TULSA, OKLAHOMA

Wells in Lake Maracaibo, Bolivar coastal district, near Cabimas, Venezuela.

Mud-Treating Procedures in Venezuela's Bolivar Coastal Field

by R. W. Beck*

Drilling-mud practice in the Bolivar Coastal field of Venezuela is directed entirely toward making the drilling operation faster, safer, and more economical. The upper hole above the productive interval is drilled with clear water to obtain the fastest possible rates of penetration. The Miocene producing sand section is drilled with a native clay mud needed to overcome the formation pressures in that interval. The Eocene productive section is drilled with an alkaline-tannate mud to prevent hydration of the marine shales. Exploratory wells penetrating the Cretaceous formation at depths below 10,000 ft. require extensively treated starch and emulsion muds to prevent caving in the Cretaceous shale intervals. This discussion describes methods perfected over a period of several years.

THE oil fields which stretch almost continuously for 80 km. along the eastern shore of Lake Maracaibo in western Venezuela constitute one of the world's greatest known accumulations of petroleum. Of the presently proved area of these fields, which are known collectively as Bolivar coastal field, something more than 50 per cent lies under the waters of Lake Maracaibo. Of that part of Bolivar coastal field which is in the lake proper, all but a narrow shore-line strip is operated by Creole Petroleum Corp. Creole's operations presently extend from about 1 km. offshore to a maximum of about 20 km. from the nearest land. Drilling is carried on in water up to 100 ft. in depth by use of caisson derrick foundations and floating drilling barges.

*Production Department, Creole Petroleum Corp.

The producing formations are sandstones of Miocene and Eocene age. The Miocene of Bolivar coastal field consists of monoclinally dipping soft shales and nonconsolidated sands. The sands are sealed up dip by shaling out, faulting, or by tar seal. The Eocene, which underlies the Miocene unconformably, is composed of medium hard shales and well consolidated sands. The accumulation of oil in the Eocene sands is controlled by truncation and overlap, modified by faulting, in contrast to the monoclinal nature of the Miocene oil sands. The Miocene productive sands under the Creole concessions are normally found in the 3,000 to 5,000-ft. interval, and the Eocene sands are encountered at depths of 4,000 to 7,000 ft.

The oil sands of Bolivar coastal field are relatively strong producers, the Miocene completions running from 400 to 1,100 bbl. of oil per day initial potential, and the Eocene completions from 1,000 to 3,500 bbl. per day. No particular problems are encountered in making satisfactory completions and it is therefore believed that the productive characteristics of the sands are not adversely affected by exposure to the filtrate from water-base muds. This factor allows all of the attention to drilling-mud treating to be directed toward getting the wells down in the fastest, safest, and most economical manner.

Four Depth Intervals

For purposes of drilling-mud treating Bolivar coastal field drilling may be divided into four approximate depth intervals as follows:

1. Surface to abont 3,500 ft.; consists of Pliocene and Miocene soft shales and water sands.
2. About 3,500 to 5,000 ft.; consists of thick, unconsolidated productive Miocene oil sands and medium hard shales.
3. About 5,000 to 7,000 ft; consists of hard, well-consolidated productive Eocene oil sands and medium hard to hard shales.
4. About 7,000 to 13,000 ft.; consists of hard Eocene sands and shales, underlain by hard Cretaceous shales and limestones in the lower part of the section.

The mud-treating procedures for each of the above intervals will be taken up below:

Upper hole above Miocene producing sands.—This section extending from lake bottom to about 3,500 ft. consists of easy-drilling shales and water sands. Except in a few areas, this section does not contain any sands with more than hydrostatic pressure, so it can be drilled with clear water. Water is generally used as a drilling fluid since it allows approximately double the rate of penetration attainable with mud.

After setting conductor pipe, the

surface hole is drilled with water to about 800 ft. The water is then displaced with a native clay mud kept in storage on the barge, and surface pipe is run and cemented. It is necessary to displace the water with mud before running casing because the hole will cave in a short time if water is left in it without circulation. Drilling below the surface casing is again resumed with water and rapid rates of penetration of the order of 100 to 150 ft. per hour are maintained all of the way down to a short distance above the top of the productive sands at a depth of about 3,500 ft.

When drilling with water, the pump suction is taken directly from the lake and the returns spill out over the top of the blowout preventer into the lake. If it is necessary to make a trip to change a bit, or for any other reason, the water is circulated out of the hole with drilling mud to keep the hole open during the time that circulation is interrupted.

Miocene productive section. — Safe control of the Miocene productive sand section topped in the neighborhood of 3,500 ft. requires the use of mud with a density of about 10.7 lb. per gallon. A short distance above this section, drilling with water is terminated, and drilling mud from a supply kept on the barge is used for further drilling.

The drilling mud used to drill the Miocene sands is obtained from mud-mixing pit on shore where it is prepared by dispersing native clay in water. This mud has very poor properties by the usual standards; however, it is inexpensive and it has sufficient density (10.7-10.8 lb. per gallon) to control the reservoir pressure of the Miocene sands. The water loss of the mud varies from 30-50 cc. in 30 minutes, and the sand content is from 5-10 per cent by volume. It is economical to use this relatively poor mud to drill the Miocene producing section because the drilling rate is fast (40-80 ft. per hour), and practically no hole trouble is experienced during the drilling operation.

Just before drilling is terminated, 25-30 sacks of bentonite are added to the mud to improve its viscosity and water-loss characteristics, so that the hole stays in good condition during the subsequent logging and casing operations. An alternate procedure used in some areas is to add from 300-400 lb. of sodium carboxymethyl cellulose to the native clay mud in the latter stages of drilling. This treatment reduces the water loss of the mud to 10-15 cc. A.P.I. to protect the hole before casing is set. Miocene wells of Bolivar coastal field usually come in strongly indicating that no significant damage is done to the sands by exposure to the relatively poor mud.

Eocene productive section. — The Eocene productive section, which directly underlies the Miocene, consists of medium-hard to hard marine shales and sands. Although this Eocene section does not present any unusual drilling difficulties, it is necessary to use a much better quality drilling fluid than is normally used in the Miocene. The reason for this is that the shale sections in the Eocene are more susceptible to hydration and sloughing when exposed to high-water-loss muds.

The drilling-mud practice for Eocene wells is identical to that for the above-described Miocene wells until just before reaching the Miocene-Eocene inconformity at about 5,000 ft. At that point the mud is treated with bentonite and caustic quebracho which disperses the clay solids, reduces the water loss, and allows the sand to settle out. By the time the Eocene has been penetrated 200-300 ft., a relatively good alkaline-tannate mud of the following properties is attained:

Density, lb. per gal.	10.8-11.0
Marsh funnel viscosity, sec.	36-40
A.P.I. filtrate rate, cc.	6- 9
Sand content, per cent	1.0- 2.0
pH	8.0- 8.5

Penetration rates in the Eocene are much lower than those in the Miocene, averaging from 5-10 ft. per hour. Total Eocene footage per well runs from 500-2,000 ft. depending on structural position, and good mud properties are maintained throughout the

(Continued on page 308)

MERCOID - GIVES YOU THAT ADDED PROTECTION

Like the proverbial expression, "A Chain Is No Stronger Than Its Weakest Link," likewise, "A Control Is No Better Than Its Electrical Contacting Mechanism."

Where open contacts are used, they are exposed to dust, dirt and corrosion, and are in the open, causing pitting and sticking of the contacting surfaces.

The Mercury Switch used exclusively in all Mercoid Controls is protected from the above handicaps, and operates indefinitely without any deterioration, thereby assuring that added safety and better performance.

If you have a control problem—involving the automatic control of pressure, temperature, liquid level, mechanical operations, etc.: it will pay you to consult Mercoid's engineering staff—always at your service.

WRITE FOR CATALOG 700-A. PLEASE MENTION THIS PUBLICATION

THE MERCOID CORPORATION
4201 BELMONT AVE. CHICAGO 41, ILL.

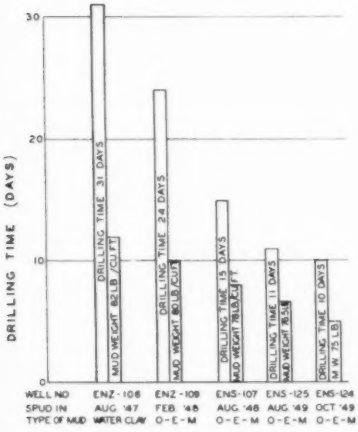

DRILLING TIME (DAYS)
30
20
10
0
DRILLING TIME 31 DAYS
MUD WEIGHT 82 LB./CU.FT.
DRILLING TIME 24 DAYS
MUD WEIGHT 80 LB./CU.FT.
DRILLING TIME 15 DAYS
MUD WEIGHT 78 LB./CU.FT.
DRILLING TIME 11 DAYS
MUD WEIGHT 75.5#
DRILLING TIME 10 DAYS
M.W. 75 LB.
WELL NO ENZ-106 ENZ-109 ENS-107 ENS-125 ENS-124
SPUD IN AUG. '47 FEB. '48 AUG. '48 AUG. '49 OCT. '49
TYPE OF MUD WATER CLAY O-E-M O-E-M O-E-M O-E-M

Fig. 1—Mud weight vs. drilling time, from 5,000 to 7,900 ft. (East Nipa).

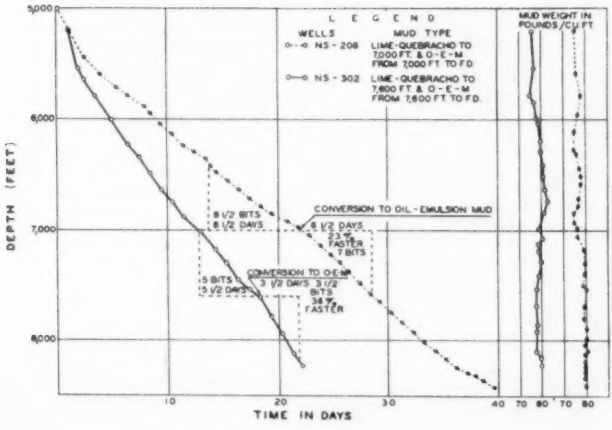


Fig. 2—Mud type vs. drilling progress.

DRILLING IN EASTERN VENEZUELA*

Footage per drilling day has increased from 216 in 1947 to more than 400. Direct rig supervision has increased 50 per cent

THIS paper presents a summary of drilling procedures which are followed in eastern Venezuela by Mene Grande Oil Co. At present time, Mene Grande's eastern division is operating 18 drilling rigs in nine producing areas, and has 4 additional rigs engaged in wildcat operations.

The drilling operations are conducted in a rectangular area which spreads over some 2,500 sq. miles. Drilling depths vary from 5,000 to 11,000 ft., with the average drilling depth being 7,500 ft.

Equipment

There are the components of 26 steam rigs and 4 power rigs available for drilling operations. The rigs range in size from heavy-duty draw works, equipped with 14 by 14-in. engines, to some few virtually obsolete draw works. Fortunately, all of the draw works and engines are of the same manufacture, and this minimizes the stocking of replacement parts due to some interchangeability of parts which exists among the different style draw works.

So far as possible, all drilling accessories are also standardized. Attempts are made to purchase the best equipment available at the time and to then use it to the absolute end of its useful life. The high cost of replacement, which is about 40 per cent more than the cost in the United States, makes it mandatory in many cases that equipment be used even though improved equipment may be available.

Steam rigs. — Preponderance of steam rigs is caused by several factors, the principal one being that Mene Grande has achieved greater operating efficiency with steam units as compared to power units. The difference in efficiency is a result of most of the drilling personnel being more familiar with steam rigs, and their being able to use them more effectively. Two other reasons for the use of steam are the plentiful supplies of gas and water available for drilling operations. These reasons no longer are as valid as they once were, as the Venezuelan Government collects a royalty of $0.10 per thousand cubic feet when the thermal energy of the gas is utilized, and this makes the fuel cost of the heavy steam rig, which uses four 150-hp. boilers, amount to about $160 per day as compared to a fuel cost of $60 per day for an equivalent power unit operating under similar conditions.

The water available is ideally suited for use as boiler feed, having few dissolved solids, and requiring no chemical treatment. During initial operations field water systems did not constitute a severe problem, for drilling was concentrated in a few areas which were near good sources of water. At this time, the problem of water supply is becoming increasingly acute, as operations are becoming more widespread, and good water sources are not at hand in some of the areas being developed. Nine widely separated water-pumping stations are now being used to supply the required water. The pumping installations vary from a simple 7¼ by 10-in. pump with 115-hp. diesel engine to a million-dollar station equipped with large four-stage centrifugal pumps and 600-hp. engines. It is to be noted that the latter station supplies water for four camps as well as four drilling rigs.

The power rigs are now beginning to achieve a greater degree of acceptance in wildcat areas where sufficient water is not available to operate steam rigs. In time, the problem of water supply may force a conversion from steam to power rigs.

Rig Moving

At present, development drilling is being conducted on 440, 616, 756, or 1,200-m. spacing, depending upon the given field. Due to the long step-outs being drilled in many areas, the geological department is unable to supply much advance notice on the next move for any given drilling rig. Until about 2 years ago, concrete bases were made on all new locations. This was expensive, but even worse than the expense was the fact that sudden changes in rig moves resulted in many bases being prepared which were never used.

Coincidental with the introduction of the use of Athey tracks for rig rolling 2 years ago, the construction of concrete bases was discontinued.

*Staff report, eastern division, Mene Grande Oil Co., San Tome, Venezuela.

and movable board mats composed of two layers of 3 by 12-in. boards were used for bases, and a considerable saving has been effected by this practice.

Once a location has been selected, the transportation department proceeds to level the location and to dig the mud pits. A contractor is employed to construct the casing rack and after it is erected the surface casing and drill pipe are moved onto location. Meanwhile water and gas lines are laid from field systems.

Unitization.—At this point, it will be necessary to describe the degree of unitization which has been incorporated into a typical Mene Grande rig. Unhampered by legal restrictions as to load, width, length, or weight, some interesting rig units have been evolved. All rigs have two slush pumps and a small wash-down service pump mounted on a large skid which makes up one unit; the boiler feed pumps, gas regulator, and steam-operated generators are mounted on one skid; and the shale shaker and chemical treating tanks comprise still another skid-mounted unit.

In most cases the steam-condensate traps and the steam engine are moved as a unit with the engine house, and the derricks, completely rigged, are rolled onto new locations with the crown block and traveling block strung up, and with the hook and kelly secured to the derrick-floor supports. The kellies are placed in unitized ratholes to prevent damage while moving. On short moves, over even terrain, the draw works and drill collars, in stands of 90 ft., are secured to the derrick and moved in this manner.

Moving derrick.—In lifting the derrick for mounting on the tracks, the draw-works side is raised first by placing four 50-ton-capacity jacks under the lift angles which are 5 by 5-in. standard angles welded to the steel derrick skid. The derrick is raised 29 in., and a tractor then spots the Athey tracks under each of the raised corners, the derrick is lowered onto the tracks, and the procedure is duplicated on the pipe-rack side of the derrick. The total load weight in some cases amounts to 184,000 lb.

The tracks now being used for rolling are the standard Athey track model 7-F which has 30-in. tracks with an 18-in. clearance between the ground and the axle. These tracks function very satisfactorily in the dry season. However, during the wet season of the year difficulty has been experienced by the sticking of the tracks, and to remedy this, arrangements are being made to procure some tracks with a 42-in. width. This increased bearing surface should alleviate this particular difficulty.

As soon as a rig is released for a new location, the rig crews start disconnecting the water, steam, and mud lines, and a special boiler-connection gang disconnects the boilers and prepares them for moving. When the various lines have been disconnected, the following automotive equipment is sent to the rig which is to be moved:

One heavy-duty boom truck (20-ton capacity).

Five heavy-duty winch trucks (20-ton capacity).

One heavy-duty truck with lowboy semitrailer.

Two light-duty boom trucks.

One Athey track lowboy.

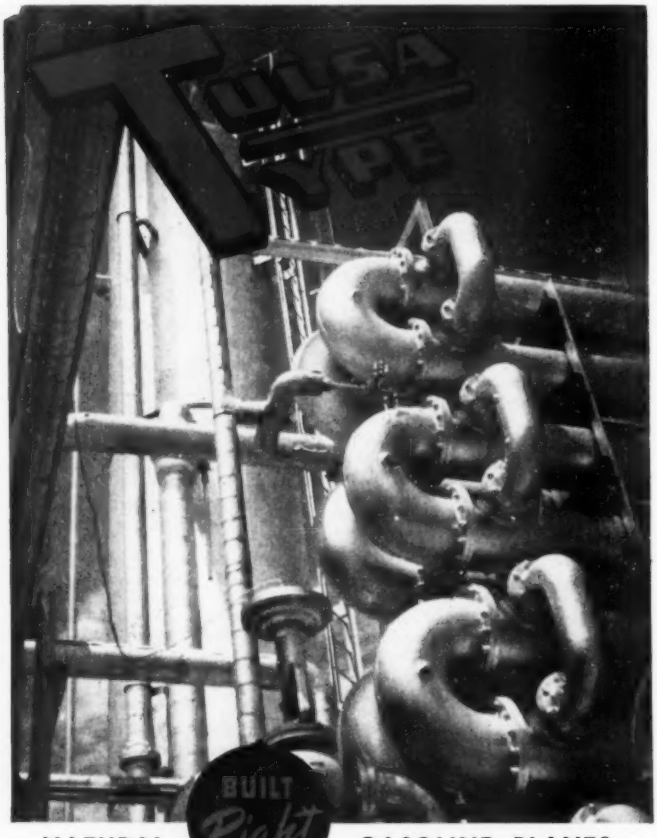
One medium-duty gondola carrying four Athey tracks.

One pickup carrying hydraulic jacks.

The engine house is skidded onto the Athey track lowboy, the pump unit is loaded on the semitrailer lowboy, the boilers are loaded on the 20-ton winch trucks, the derrick is placed on tracks, and the rig is moved to the new location.

Elapsed time from the start of the teardown until the rig is ready to spud in at the new location is frequently less than 24 hours. This constitutes a considerable saving in time over the 5-day period normally required to rig up a bare derrick.

Derricks have been rolled distances up to 20 miles in 2 days' time, and the required rigging-up time was so reduced as to make this advantageous. During 1950, 128 wells were drilled, and it was necessary to tear down and rebuild only six derricks,



NATURAL GASOLINE PLANTS

- *Oil Refinery Equipment*
- *Steel Plate Fabrication*
- *Structural Steel*
- *Chemical Processing Equipment*

FLINT STEEL CORPORATION
TULSA, OKLAHOMA

these derricks being moved into wildcat areas.

Casing Programs

The casing programs for the individual wells vary greatly since the desired weight and size of casing is not always available. The use of mixed strings has become general practice only recently in order more effectively to utilize the tonnage allocations of casing. Previously, to minimize stock and handling problems, only a minimum number of sizes and weights of casing were used.

The most popular program and the one most commonly used, employs 9⅝-in. surface casing with a 5½-in. oil string. The use of 13⅜-in. surface casing with 9⅝-in. intermediate strings has been eliminated on all drilling operations except the wildcats in order to save time and to reduce casing requirements.

The surface strings of 9⅝-in. are set at depths varying from 500 ft. in shallow drilling operations to 4,000 ft. in the deeper areas. The wells are spudded in with 14-in. three-way drag bits. Generally one bit is sufficient to reach the depth for surface casing, but where several thousand feet of surface casing is to be set, additional 12¼-in. tricone bits are used to reach the desired depth.

Blowout preventers. — In development drilling, a 10-in. Series 900 Cameron master gate is installed on the casing head, and a 10-in. Series 900 QRC with 4½-in. drill-pipe rams is installed above the master gate for blowout prevention. On wildcats, a 10-in. Series 900 master gate, 10-in. Series 900 QRC, a mud cross with 6 and 3-in. outlets, and a 10-in. Series 900 Hydril GK preventer are used. A 6-in. Series 900 Cameron master gate is placed on one side of the cross, and a high-pressure full-opening valve is installed on the other side.

The control manifold is located on the derrick floor close to the drilling controls, and has connections for using the 10 by 5 by 10-in. washdown water pump or the slush pumps for opening and closing. Instructions call for the operating of the blowout preventers every tour and their pressure testing when a round trip is made.

Drilling Practices

An 8½-in. hole is drilled inside the 9⅝-in. casing to final depth. A limited amount of experimentation with jet and combination jet bits has been done, and although a favorable rate of penetration has been achieved, hole deviation has been greater than desired. Jet bits promise to have widespread applications in eastern Venezuelan operations, and a series of complete field tests of various type jets are to be made soon.

Hole deviation.—This does not offer a serious problem in most areas. Totco surveys are made at 300-400-ft. intervals, and attempts are made to limit the deviation to 3° or less. The surveys are discontinued after reaching 4,000 ft., and unless severe difficulties are experienced, no further attempts are made to maintain a 3° deviation.

As can be imagined, the drilling fluid and its condition sometimes become controversial subjects when the deviation increases below 4,000 ft. There are two areas where steeply dipping formations make hole deviation a serious problem. In these areas, the most successful solution to date has been to use high-speed rotation and a bit weight of less than 2,000 lb. The rate of penetration is very low, and attempts are being made to improve the permissible bit weight by the use of various types of stabilizers.

Bit weight.—The amount of bit weight used varies a great deal with the various drilling personnel. There are still some isolated cases where the swivel bail is used to give an indication of the weight being used on the bit; however, as a general practice, fifteen 6-in.-diameter, 2¾-in. bore, 30-ft. drill collars are used to keep the drill pipe in tension. The bit carries 35,000 lb., which amounts to about 80 per cent of the effective weight of the drill collars.

Larger drill collars are used in drilling 12¼-in. holes where long strings of 9⅝-in. casing are to be set.

CUT CORROSION COSTS
Specify HOT-DIP GALVANIZING after Fabrication

HOT DIP GALVANIZING
PICKLING & PAINTING

P.S.—PAINT LASTS 7 TO 8 TIMES AS LONG ON GALVANIZED STEEL

NO JOB TOO LARGE

BOYLES

IT CAN'T BE TOO SMALL

BOYLES GALVANIZING COMPANY

3349 W. 5th St. TULSA, OKLAHOMA Phone 3-9158

The drill stem is rotated at a speed of 250 to 300 r.p.m.

The slush pumps are operated at as high a speed as can be maintained with the available steam pressure. Usually one slush pump is used, but in some cases the pumps are operated in series with a resulting slight increase in the rate of penetration.

The largest-size pistons and liners that can be installed in the pumps are used until the oil string is set, and then the size is reduced to provide higher pressures. The pumps are not compounded during drilling, for even in the deepest areas drilled, the 22-in. pumps give sufficient circulation without resorting to compounding.

Drill pipe.—All operations use 4½-in., 16.6-lb. drill pipe. The drill pipe being used is composed of strings with various style tool joints, the question of supply having dictated to a large degree the type to be used. Until recently, A.P.I. regular, Acme streamline, A.P.I. full-hole, and modified internal flush tool joints with both 18° upset and square shoulders were in use.

To alleviate the constant search for rotary subs, and to permit the maximum usage to be obtained from each joint of drill pipe, the modified internal flush tool joint with the 18° upset shoulder was accepted as a standard. By the end of 1951 this style pipe should be used exclusively.

Periodic external examination is made of each string, and the downgraded joints are moved to the shallow drilling areas. Upon being down graded from the shallow areas, the pipe is junked for drilling purposes but it may be made into high-pressure gas-injection lines or utilized wherever tubular material is required. Portable trailer-mounted hydraulic pipe straighteners are used to straighten the drill strings if excessive bending occurs.

Drilling Fluid

The treatment of drilling fluid begins at depths of 4,000 ft. in most areas, and physical and chemical properties of the mud are controlled closely until the oil-string casing is set. After setting the oil-string casing, the mud is given little attention, the treatment being limited to the maintenance of a sufficiently heavy mud to eliminate danger of blowouts, and the removal of cement contamination.

The drilling fluid control is handled by a staff of 10 mud technicians who are provided with the conventional testing equipment to make determinations of fluid loss, weight, sand content, viscosity, gel strength, and pH. The technicians are assigned to the various drilling areas, and it is their responsibility to maintain the mud in the desired state by frequent examination with resultant recommenations for treatment.

Faster drilling.—The control of drilling-fluid properties has received a great deal of attention in recent years, and this has resulted in faster rates of penetration and reduced mud costs. The drilling fluids now in use may be divided into three classifications: (1) conventional water-clay, (2) oil emulsion, and (3) lime-starch.

The oil-emulsion mud is used in practically all development drilling, the conventional clay and lime-starch systems being used on long stepouts and wildcats where the oil contamination of side-wall samples would hinder the geological interpretation of the samples. The lime-starch mud is also used in some of the deep development drilling wells where a lower water loss is desired than can be readily achieved with the conventional oil-emulsion mud.

Drilling "emulsion."—The oil-emulsion mud is not a true emulsion with an emulsifying agent but rather a mechanical emulsion established by the affinity of bentonitic particles for oil globules. Its preparation and maintenance is very simple. Bentonite is added to the mud until a 10-cc. fluid loss (standard A.P.I. determination) is achieved. Quebracho is added in the ratio of about 1 lb. per barrel, and 25 per cent by volume of oil is added. The oil used is a residuum,

new McCORD
TUBULAR "CLEARSITE" FEED
SF LUBRICATOR

The new, improved McCord Tubular "Clearsite" Feed is the latest development in lubricator visible sight feeds. Less susceptible to clouding, it carries a greater supply of liquid and may be cleaned without removing it from the pump or disconnecting it from the oil line. The McCord "SF" Lubricator provides close and accurate feed adjustments with a degree of reliability that has made this the preferred lubricator in the oil field. The advantages of easy removal of pump units, welded steel tanks, the wide variety of drives, and the new type graduated oil level gauge which provides clearer visibility are McCord features that make the "SF" Lubricator outstanding. Lubricators are in stock and deliveries are prompt.

Lubricator Division
McCORD CORPORATION • Detroit 11, Mich.

and of as low a gravity as can be obtained, which is generally about 18°. Muds having 5-cc. water losses with 60-second viscosities (Marsh funnel 1,500 cc. in, 1,000 cc. out) are achieved in this manner. The maintenance of the system requires the addition of quebracho, or sodium acid pyrophosphate for thinning purposes and oil and bentonite to give the desired degree of gelification and fluid-loss reduction. Occasionally carboxymethylcellulose is added to secure additional reduction in fluid loss. Water is added as drilling progresses to maintain the desired water-oil ratio.

This type mud was first introduced to eastern Venezuela in 1948, and its first successful field trials led to its being accepted as the standard mud for development drilling. From time to time various emulsifying agents have been tested, but the added cost of such agents has offset the advantage which they offer. Initially large quantities of caustic soda were used with the quebracho in treating the mud, but there were numerous indications that the caustic created spalling of the shale sections being drilled and its use has been discontinued.

Lime-starch. — The oil-emulsion mud shows some tendency to break down under the higher pressures and temperatures encountered in deep drilling. This is probably due to the lack of a true emulsifying agent, and in these areas the lime-starch systems are used. The present lime-starch systems have been developed after numerous attempts using various types of materials.

The following procedure is used at present with lime-starch systems. Conventional mud is used until intermediate or surface casing is set. While waiting for nippling up to be completed, the mud in the pits is treated with about 6 lb. per barrel of lime, and 1 lb. per barrel of Kembreak. Small amounts of caustic soda may be added to raise the alkalinity to the desired point. After this treatment, the mud exhibits extremely low viscosity and gel strength. The mud in the casing, being untreated, acts to increase the viscosity and gel strength, and upon resumption of drilling, additional thinner is added and starch is added to achieve the desired water loss. The low viscosity and gel strengths allow mud weights of 86 lb. per cubic foot to be maintained without the addition of weighting material. The properties of the mud are maintained by the addition of lime, starch, and Kembreak with caustic soda used infrequently to raise the alkalinity. It is believed that the filtrate, being saturated with calcium ions, impedes spalling of shale sections being drilled. This type mud system has been used in several wells, and although all the questions about this system are not answered, it still provides a satisfactory drilling fluid to be used in any area now being drilled.

TABLE 1—SUMMARY OF DRILLING RATES—1947-1950

Year	Footage drilled	Days drilling	Footage per day	Average depth (ft.)	Average No. rigs	Average No. direct supervisors
1947	488,311	2,224.2	216	7,150	24.7	51.0
1948	816,846	3,546.9	230	7,200	30.3	58.5
1949	1,003,632	3,853.8	262	7,700	23.6	62.5
1950	912,649	2,268.3	405	7,550	17.7	60.0

Reducing mud weight.—The East Nipa area was selected as a trial area, and the mud weight was lowered on successive wells drilled by the same rig and crews with the same general bit programs on each well. Fig. 1 very clearly illustrates the remarkable reduction in drilling time partially achieved by a reduction in mud weight. It is shown that the drilling time decreased by nearly 66 per cent in this area between August 1947 and early 1949. Naturally some of this improvement resulted from improved labor and better equipment, but a substantial portion of the improvement is attributed to the lighter drilling fluid.

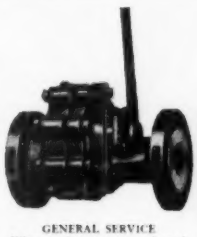
Fig. 2 shows the improvement resulting from conversion to oil emulsion in two wells which were drilled to 7,000 ft. using clay mud, and then converted to oil emulsion. In one case, a 36 per cent increase was achieved in rate of penetration and in the other well, a 23 per cent increase was obtained. This increase was made in the lower portion of the holes, and constitutes a distinct reversal of normal drilling where penetration almost invariably declines as the hole is deepened.

The increased attention given to drilling fluid has brought about an over-all 50 per cent reduction in mud costs since 1948. This has resulted from closer supervision of chemical treatment, and in the decreased consumption of weighting material. With over 100 wells being drilled annually in this area, the saving has been appreciable.

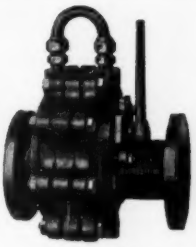
Cementation

The procedure followed in the cementation of casing is one that is utilized in many sections where Gulf Oil Corp. conducts drilling operations. Spiral-type centralizers and scratchers are installed on the casing at the ratio of one centralizer and six scratchers for every 90 ft. of casing to the uppermost sand in the well which shows productive possibilities. Caliper surveys are made on the first wells drilled in each area, and the amount of cement required as shown by these surveys is used as a basis for deciding the amount to be used in subsequent wells.

FIRE PROTECTION
Closing type for inflammable liquid emergency shut-off, or opening type for deluge or drainage, assuring immediate and positive action with weighted pendulum stop.



GENERAL SERVICE
Wherever frequent use and quick operation is required for any liquid or gas at pressures up to 300 psi. These valves have outside stuffing box and gland.



STEAM JACKETED
Assures continued free flow of any material which congeals at ordinary temperatures.

BOILER BLOW-OFF
Quick-opening, also handwheel operated. Angle and "Y" types and combination units meeting ASME Code requirements for pressures up to 600 psi.

"Everlasting" Protection

Quick-Action . . . opened or closed with less than a quarter turn of the operating lever.

Straight-Through Flow . . . the disc cannot become loose and accidentally check the flow.

Drop-Tight Seal . . . constant contact of disc and seat at all times prevents dirt or scale from getting between.

Self Regrinding . . . the disc rotates on the seat with each operation, thus regrinding the sealing surfaces.

No wedge action . . . all parts move between parallel faces.

Write for bulletin describing EVERLASTING VALVES in detail.

EVERLASTING VALVE COMPANY
49 Fisk Street, Jersey City 5, N. J.

Everlasting Valves

Trade-Mark "EVERLASTING" REG. U. S. PAT. OFF.

Instructions call for the filling of each joint of casing with mud as it is run, and the establishment of circulation after running every 20 joints. On surface strings of less than 1,000 ft., only a baffle plate is used. On strings longer than this, a combination guide-float collar is used. The bottom three joints are welded to eliminate the possibility of their being backed off during deepening or cleanout operations.

After the casing has been run to the desired depth, it is reciprocated a distance equal to the length of a joint of casing. This reciprocation is continued until the amount of cuttings being cleaned from the hole reached a minimum. Cement slurry is then mixed and displaced using a single plug for the operation. Weatherford cementing heads are used to release the plug. The rig pumps in compound and the pumps of the Halliburton trucks are used to pump down the plug. Immediately after the plug hits, the pressure is bled back to 500 psi., and the cement is allowed to stand 12 hours before releasing the pressure. Frequent temperature surveys are made to check on the amount of cement fillup.

Personnel

The drilling crews consist entirely of Venezuelan workers. The ordinary crew assigned to a heavy rig consists of seven men: a driller, derrick man, caporal, fireman, and three floor hands. These men work an 8-hour day, 6 days a week, and change tours weekly. Their transportation to and from work is provided by the company, and travel time is paid at a bonus rate 25 per cent greater than regular pay. In addition, a 20 per cent bonus is paid for night work, and 7 days' pay is paid for 6 days' work.

The various bonus stipulations make the average Venezuelan oil worker one of the highest paid in the world. Foreign-staff tour tool pushers are assigned to one or two rigs depending upon the location of the rigs and the availability of foreign-staff tool pushers. The difference in language between the foreign staff and Venezuelans sometimes creates problems. The company, in recognition of this problem, has developed a compulsory Spanish training program for foreign-staff personnel and it is hoped that this will minimize this problem. Fortunately most Americans soon acquire a working knowledge of Spanish, and the work goes on satisfactorily.

Drilling Rates

Table 1 presents a summary of the drilling rates for the years 1947 to 1950 inclusive.

Footage per drilling day has increased from 216 ft. in 1947 to 405 ft. in 1950. A combination of several factors is responsible for this improvement. Better equipment has been one factor, for even though some decidedly antiquated equipment is still being used, some, even more antiquated, has been replaced in the past few years. Better bit selection has also contributed to the increased efficiency. In 1948, many short-tooth-type bits were used to drill formations which are now drilled with long-tooth bits. This has resulted in greater rates of penetration and as much as 50 per cent reduction in rock-bit consumption. As previously stated, better mud control has contributed to the improvement, as has the increased amount of direct supervision. The direct supervision given a rig has been increased more than 50 per cent since 1947.

"To each and all of ye, a verra Merrie Christmas from Scottie (Santa) McBlock"
SOMETHING NEW HAS BEEN ADDED
9,000 STREAMLINED POUNDS! !
NEW
300 ton rated capacity
NEW
Double row, pre-adjusted, Timken bearings mounted on 8 inch diameter shaft.
NEW
Johns-Manville "Klipper" grease seals, self adjusting. Positively retain lubricant.
NEW
E-Z opening guards for quick stringing up.
NEW
42" diameter alloy steel flame hardened sheaves, 9,000 streamlined pounds for fast falls and quicker round trips.
McKissick Builds A Better Block for Every Purpose.
Write for catalog
McKISSICK
McKISSICK PRODUCTS CORPORATION
Box 2496 Tulsa, Oklahoma

BOOKS

SINCE SPINDLETOP—A HUMAN STORY OF GULF'S FIRST HALF CENTURY. By Craig Thompson. Published by Gulf Oil Corp., Pittsburgh. 109 pp.

This handsome volume was published to commemorate the occasion of Gulf Oil's fiftieth anniversary. As implied in its subtitle, the book is not intended as a detailed history of the company, but rather as a human story of the company's first 50 years. As a consequence, it is not a recital of the names of all men and women who have made contributions to the firm's progress. The book is profusely illustrated.

The Drilling Contractor's Superintendent

Nearly 90% of the 44,000 wells to be completed this year, will be drilled by Drilling Contractors. Consider the problems to be solved, the complexities to be faced, and the responsibilities involved in so huge a schedule of operations, and you will gain some idea of the importance of the Contractor's chief field officer . . . the Drilling Superintendent.

A Drilling Superintendent will in some cases supervise fifteen or more drilling rigs representing, in rotary territory, an investment of from 2 to 10 million dollars. He is a drilling expert of long experience.

Since every oil well represents a different and often a unique problem, the Superintendent's job is multiplex. He must be expert in his selection of Tool Pushers, must work with them in selecting Drillers, cooperate with them in planning each well. He must know rigs and equipment, be ready with sound advice on any phase of the job, assist in handling such problems as wild wells, difficult fishing jobs, etc. He must be familiar with the many special organizations offering logging, directional drilling, fishing services, etc.; must understand all completion techniques. In a word, he must be a past master in every phase of well drilling.

Fine equipment is one of the basic factors which enable him to establish a reputation for fast, straight hole. For 25 years MISSION has been one of his valued allies in this department. He has found MISSION equipment unsurpassed in efficiency, dependability, and durability . . . has found that it reduces hazards, lowers equipment costs, helps him hold to the minimum time and cost per foot of hole.

MISSION MANUFACTURING CO.

Mission Mfg. Co., Houston, Tex. Export 30 Rockefeller Plaza, New York. Europe: London, England

What's NEW

In Perforating, Testing, and Fishing Tool Services

McCULLOUGH®
NEW SERVICES • NEW TOOLS
NEW WAYS OF DOING THINGS

Latest News About New Tools, Techniques and Services

SAVE TIME, MONEY and PIPE

With McCullough Jet Back-Off Tool or String Shot Service and the One and Only Magna-Tector!

Pipe is scarce and rig time is costly. What could be more economical than backing-off the pipe, recovering all free pipe above the stuck point in one piece, and getting it done in a fraction of the time?

Yet there are limitations in the use of only ONE back-off tool in attempting to free stuck drill pipe, drill collars, subs, casing, tubing and wash pipe. NO ONE TOOL can accomplish EVERY back-off job. But there are TWO back-off tools and between the two, EVERY TYPE OF back-off job can be accomplished!

That is why McCullough crews arrive at your well with both the McCullough Jet Back-Off Tool and String Shot. These tools plus the McCullough Magna-Tector, that quickly and accurately locates the stuck point, represent an extremely versatile combination service designed to save you time, money and pipe.

These are NOT mechanical tools or fishing tools. They are progressive tools, electronically controlled for accuracy and speed. They are responsible for the sharp decline in fishing in recent years, permitting wells to be drilled faster—saving oil operators thousands of dollars!

HOW YOU SAVE TIME, MONEY AND PIPE

1. TIME SAVER

a. Accuracy of the McCullough Magna-Tector in locating the stuck point consistently, eliminates unnecessary back-off shots.

b. New, high-temperature, high-pressure resistant detonators in the back-off tools eliminate misruns.

c. These electric wire line tools are run into and out of the well in a fraction of the time required with mechanical cutters.

d. In addition they are electronically controlled permitting greater speed and accuracy than ordinary electric wire line tools.

e. Electronics also provide MORE information about conditions in the well — locating collars, tight places, fluid level, etc., both audibly and visibly.

2. MONEY SAVER

a. McCullough Back-Off Service accomplishes ANY TYPE of back-off job, leaving the fish in good condition for subsequent operations.

b. The use and need of a rotary table is eliminated.

c. McCullough Magna-Tector, many times indicates that working and spotting oil will free the pipe, eliminating the need of backing-off and fishing.

d. Guesswork is eliminated.

3. PIPE SAVER

a. Eliminates cutting and damage to the pipe.

b. Permits recovery of all free pipe in one piece and the freeing and recovery of all stuck pipe in undamaged sections.

WHAT TO DO

When your pipe becomes stuck — CALL McCULLOUGH IMMEDIATELY! The McCullough Magna-Tector will quickly locate the lowest free point, the stuck point and do it accurately. Then the McCullough Back-Off Service will free all loose pipe in one piece—simplifying the fishing job.

Since time is important McCullough Back-Off Service is fast. All free pipe will be removed BEFORE it can stick further up the hole.

No two stuck pipe conditions are exactly alike. This is another reason why you NEED McCullough VERSATILE Back-Off Service. The complete equipment, the skill of experienced McCullough crews, and the special techniques they have devised WILL SAVE YOU TIME, MONEY AND PIPE!

Call McCULLOUGH!

WRITE FOR THIS CATALOG

Pages 3228 to 3231 in the McCullough section of the Composite Catalog describes these tools individually and in detail — with illustrations, specifications and operating data. Write for your free copy today.

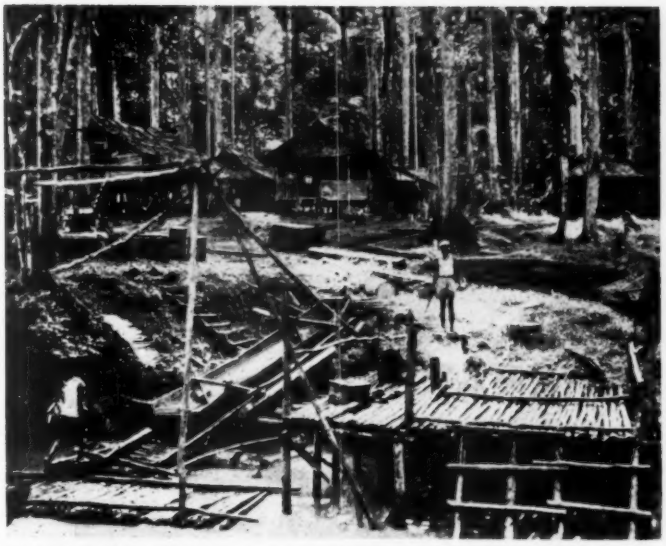
PERFORATING, TESTING AND FISHING SERVICE ANYWHERE — ANYTIME!

McCULLOUGH TOOL COMPANY
5820 South Alameda Street, Los Angeles 58, California
405 McCarty Street (P.O. Box 2575) • Houston, Texas
CANADA: Edmonton, Alberta • EXPORT OFFICE: Los Angeles, California
VENEZUELA: United Oilwell Service Co., S.A.; Caracas, Anaco, Maracaibo

SERVICE LOCATIONS: **TEXAS:** Houston, Snyder, Alice, Cisco, Corpus Christi, McAllen, Odessa, Tyler, San Angelo, Victoria, Wichita Falls. **OKLAHOMA:** Oklahoma City, Guymon, Healdton. **MISSISSIPPI:** Laurel. **NEW MEXICO:** Hobbs. **KANSAS:** Great Bend. **WYOMING:** Casper. **CALIFORNIA:** Los Angeles, Avenal, Bakersfield, Ventura. **LOUISIANA:** Houma, Lake Charles, New Iberia, Shreveport. **COLORADO:** Sterling.

Oil Exploration In Western New Guinea

More than 50 million dollars has already been spent in opening up this vast territory, and much work still remains to be done to bring New Guinea on the oil map as a substantial producer.



JUNGLE OUTPOST.—Geological camp on the Klasafet River, New Guinea, temporary home for Nederlandsche Nieuw Guinea Petroleum Maatschappij geologists searching for oil on this remote Far East island. Streams are chief means of traversing dense jungle. Klamono field in this area is already shipping crude oil.

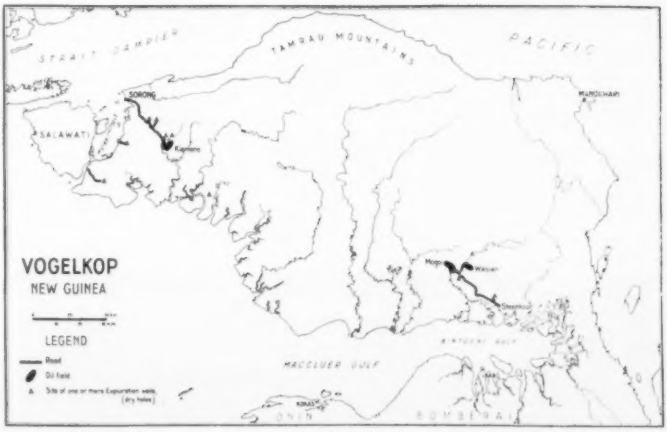
IN 1935 exploration rights were acquired by Netherlands New Guinea Petroleum Co. for an area of roughly 23.8 million acres, or about one-quarter of the practically unexplored western half of New Guinea. Of this extensive area only 10 per cent can finally be selected for exploitation. The company, known for short as N.N.G.P.M., is a joint venture of three principal oil companies, comprising the Royal Dutch-Shell Group through the Bataafsche Petroleum Maatschappij (40 per cent), Standard-Vacuum Oil Co. (40 per cent), and Far Pacific Investments, Inc., (jointly owned by Standard Oil Co. of California and The Texas Co.) (20 per cent). The management of the company is in the hands of the Bataafsche.

Exploration activity started in 1936 from headquarters at Babo in the Bintuni Gulf with an aerial survey, having as its object acquisition of as much basic topographical and geological information as possible within a short time. Owing to unfavorable climatic conditions, a total of more than 2,000 flying hours in little more than 2 years were needed to cover the whole license area with 16,000 photographs. On an average, only 20 minutes each day was suitable for photographic operations.

Aided by photogeological maps to a scale of 1 : 40,000, geological reconnaissance parties further investigated most of the jungle-covered dry land of the contract area. This reconnaissance work was completed in about 3 years, and the basic geological maps 1 : 100,000 enabled the company to select the most promising areas and reduce the original acreage by 3,700,000 acres.

With a network of 40 Holweck Pendulum stations a regional gravimetric picture was obtained, which was progressively completed in further detail, partly with the help of 6,000 torsion-balance stations and 2,200 Thyssen gravimeter stations. This prewar gravimetric work covered an area of about 3½ million acres. Detailed geological work followed, together with seismic surveys carried out by contractor parties in the lowlands, to a total of 870 miles of profiles. Some sections measured with the magnetometer have shown this method to be ineffective.

The discovery, in the middle of 1936, of Klamono field, producing heavy crude from 300 to 350 ft., was a great encouragement for the young company and initiated extensive drilling activity in the wild jungle and unhealthful swamps of New Guinea. Up to the outbreak of the war in the Pacific, 106 structure drilling holes, 9 stratigraphic tests, 10 exploration wells, and 14 exploitation wells had been drilled, with a total footage of about 131.000 ft. The deepest well drilled up till then was 39 Sele, which penetrated through the whole Tertiary sequence and reached the Jura-Cretaceous beds, with a final depth of 9,840 ft.



Apart from the 8 producing wells of the 14 on the Klamono structure, all this drilling activity only resulted in 5 positive results, all of these located in the eastern part of the Vogelkop area.

The outbreak of the war in the Pacific brought the activity of N.N.G.P.M. to an abrupt end, and the company was forced temporarily to abandon the whole project. The crews were successfully evacuated, all essential materials destroyed, and all equipment which could not be transported denied to the enemy by dumping it in the rivers.

When the company resumed its activities in 1946, it was found that the former headquarters at Babo was a total loss. Everything had to start anew from scratch.

Morotai in the Moluccas, which became well known from its use during the war as the springboard for the invasion of the Philippines by the Allied forces, served as a temporary headquarters. Use was made of the Allied airfield, the famous Pitoe landing strip, and temporary houses were built on the site of the former Australian camp at Tanjong Gila on the southeastern coral spit of Morotai Island. In this way it was possible to start work on the distant mainland of New Guinea where, on the west coast of the Vogelkop, opposite the small Island of Doom at the entrance to Sele Strait, the new base of Sorong was carved out of the jungle and Morotai was gradually abandoned. Shortage of trained labor, housing, means of transport over sea, and long delivery times for necessary materials greatly hampered the revival of N.N.G.P.M. This shortage of equipment could only partly be made up by the use of surplus war materials scattered over the whole of western New Guinea.

By March 1946, the first geological party was again out in the jungle of New Guinea. It then appeared that the Japanese had worked on Klamono field but had not been able to produce an appreciable amount of crude oil.

Sorong, the new base, on the west coast of the Vogelkop was originally a tiny missionary settlement facing the never-ending jungle of New Guinea. This headquarters has a well-protected harbor where all incoming supplies and equipment are assembled. From this place the various field parties and inland centers are provided with materials and foodstuffs. Housing accommodations for staff and labor, offices, warehouses, workshops, electric-power stations arose within a short time. Jetties for seagoing vessels were built to replace primitive slipways. Tank storage with a capacity of over 200,000 bbl. and a dock followed. At times during the heavy postwar construction period as many as 9,000 locally recruited laborers were employed in the Vogelkop area.

Sorong is proud of its well-equipped hospital and medical staff. Recreation buildings and schools were added, and health conditions were greatly improved by means of a successful antimalaria campaign which included the spraying of insecticides from aircraft. An abandoned airstrip on the site of the airfield which once served the aerial survey located on Jefman Island was reconditioned, and now serves as the flying base for the settlement.

The indigenous population of New Guinea make usable field labor. A training center was established at Sorong for the purpose of building up a stock of trained craftsmen such as carpenters, mechanics, and electricians. However, only a few of the Papuans retain an interest in their job. They return too quickly to their easy native life of fishing, hunting, and the gathering of sago, which grows abundantly in the extensive fresh water swamps, and is their staple diet. The shortage of labor in this thinly populated country is one of the main problems which N.N.G.P.M. has to face.

Nowadays Sorong is the largest and best-equipped center of activity in the western part of New Guinea. A European staff of about 250 and a labor force of 5,200 men are employed by N.N.G.P.M., and they, together with the families of the European staff, form the largest community in this area.

"Yes, sir, with Foster Catheads you get easy operation and durability, too, because of well lubricated heavy bearings. (Be sure to use only soft or semi-fluid grease.)

"The superior design of these Catheads . . . perfection in design and manufacture acquired by more than a quarter century of specialization . . . assures you of years of top performance.

"If you're not already using our Safety Rope Guard, better check into it now. This Safety Rope Guard attaches to any Foster friction cathead. It is inexpensive and easy to install."

Here are features on both the Air Master Breakout and Air Spinning Catheads: Precise control . . . No adjustments . . . Direct diaphragm actuated . . . Instant disengagement . . . Crawl free drum . . . Fully enclosed . . . Quick change jerkline . . . Peak performance PLUS . . . Triple plate clutch on the Air Master Breakout . . . and single plate friction clutch for line pulls up to 12,000 lbs. on the Air Spinning Cathead.

There's a Foster Cathead for Every Need.

Foster CATHEAD COMPANY
P. O. BOX 1675 WICHITA FALLS, TEXAS
FACTORY REPRESENTATIVES
O. W. Fragge, Casper, Wyo. — Greenhead Service Co., Oklahoma City, Okla. — Tillery & Parks, Odessa, Texas — R. D. Cloninger, Lafayette, La. — R. N. Bean, Los Angeles 15, Cal.

The exploration-drilling activity in the Klamono area had been resumed, with the aid of drilling outfits left by the Japanese, by the end of 1947. Since then 13 exploration wells have been drilled in East and West Vogelkop, with a maximum depth of 8,800 ft. and total footage of 41,000 ft.

Exploitation drilling was restarted on Klamono field 1 year later and the field has since been completely drilled up by adding 24 wells to the 14 prewar wells. These postwar wells have an avearge depth of 590 ft., and drilling to a total of 14,200 ft. was required.

Next to the establishment of Sorong the main feature of the postwar period has been the completion of a road 30 miles in length and the laying of an 8-in. pipe line parallel to this road through the jungle connecting Klamono field with Klasafet River Klamóno field with the harbor of Sorong. Klamono can be reached along the Klasafet River, which is, however, only navigable for small craft. Although 30 miles is not an impressive distance, it should be realized that this work was accomplished in a country where it rains on an average every other day throughout the year, with a total yearly rainfall up to 140 in. Anyone with experience of tropical jungle conditions can guess the amount of work and difficulties experienced in building the road and laying the pipe line.

Completion of this project made it possible in December 1948—after 12 years of exploratory work—for the first tanker load of 84,000 bbl. of Klamono crude to be loaded in Sorong and shipped to Java, where it was processed. After a long struggle, oil from New Guinea had at last reached the market!

The Klamono oil is of asphaltic base, gravity 18.8° A.P.I. The danger of coning up the water table prevents pumping production from being increased. Accordingly, an average daily production of 4,700 bbl. is maintained for Klamono field, the total production of which, up to October 1, 1951, has been 4,500,000 bbl.

Klamono field also helped to solve the riddle of the geology of New Guinea. It was found that the oil occurs in a Miocene reef limestone (Bioherm). This is one of the reasons why geophysical parties have again been active in New Guinea since 1948. Apart from three geological parties, two gravity and two seismic parties are employed. Experience in the United States and Canada has shown how difficult it is to discover buried reefs. Reflections are poor and the only good refractor is a sedimentary limestone on which the reefs are supposed to have grown. Differences in specific gravity between the coral limestone and the surrounding and covering marls make the gravimeter a suitable tool, but only in those areas where the reefs occur at shallow depths. Compactional dips may also indicate buried reefs, but several structures have been drilled without showing a limestone core. These facts explain, at any rate in part, the relatively high percentage of unsuccessful wells. On the other hand, however, bioherms can contain extremely thick oil columns, as was found in one of the fields showing an oil column the maximum thickness of which is roughly 420 ft. New seismic techniques, studies of the exposed reef limestone area, and regional basin studies, have to provide new means for solution of the intricate reef pattern.

Since 1947 N.N.G.P.M. has also been engaged in opening up the eastern Vogelkop area where two further fields, Mogoi and Wasian, were proven in 1940. Before the war the Tembuni River was used as a means of transportation, but owing to the varying water level and the large quantity of timber which chokes the river, this waterway was not considered suitable as permanent means of communication. A road, 31 miles in length, running from the tidal Steenkool River to the fields of Mogoi and Wasian, is therefore under construction, and a pipe line is planned for the near future.

RED DEVIL

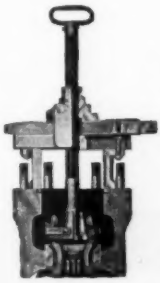
SLUSH PUMP VALVES

For high pressure abrasive service

In the manufacture of Red Devil Valves, particular emphasis has been given to HIGH PRESSURE ABRASIVE SERVICE at lowest possible operating costs. Their design is unique in simplicity, having only 5 parts. Valve and Seat are drop forged for maximum strength and processed for a deep high-carbon case to withstand excessive abrasive action. Seat has the least possible flow restriction and flat surface on bottom provides easy removal with Valve Seat Puller. "DIA-TEX" Inserts are Oil and Heat Resistant and can be reversed when worn on one side to double their long service life.

Write for Catalog No. P-110.

SPRING LOCK WASHER | VALVE INSERT PLATE | REVERSIBLE "DIA-TEX" VALVE INSERT | VALVE | VALVE SEAT



RED DEVIL VALVE SEAT PULLER

Provides a fast and positive means for pulling badly stuck valve seats by gripping the bottom rim of the seat. Eliminates the expense and hazards of removing seats with a cutting torch. All parts are made of highest grade alloy steel. Write for Catalog No. P-111.

CONSULT YOUR COMPOSITE. For full information on Red Devil Valves, Pullers and other Products, see Composite Catalog or write for price catalogs noted above. Red Devil Products are available through your supply store.

OIL WELL MANUFACTURING CORP.

6002 South Alameda St., Los Angeles 1, California

Since the war two new productive wells have been added to the three wells drilled before 1941 at Mogoi. They reached the oil-bearing limestone at an average depth of 1,250 ft. Rehabilitation is in progress of the two prewar wells at Wasian, which wells had shows in the same limestone as at Mogoi. These wells have the top of the limestone at about 2,730 and 2,950 ft., respectively. In contrast to the Klamono oil, the crude of the Mogoi and Wasian fields has a paraffinic base, with a gravity of 46° and 48° A.P.I.

For shipment of future production from East Vogelkop a second terminal has to be built in the Bintuni Gulf. To give some idea of the enormous work involved, it can be said that for this terminal it may even be necessary to deepen a tidal river which gives access to the mangrove-covered land.

It is clear that such a tremendous enterprise as that discussed here, which actually means opening up the vast territory of Netherlands New Guinea, requires huge investments, and the companies involved will have to wait many years for their financial reward. Up to the outbreak of the war in the Pacific a total of about 25,000,000 guilders was spent on initial exploration. Rehabilitation and further intensive exploration since the war, added up to the end of 1950 a further 175,000,000 guilders to this amount, so that more than $50,000,000 has been spent already. And a vast amount of exploration work still remains to be done.

Netherlands New Guinea Petroleum Co. will undoubtedly spare no effort to bring New Guinea on to the oil map as a substantial producer.

REMOVES PARAFFIN
•
NO WELDING NECESSARY
•
SAVE TIME • MONEY

INSTALLED AT WELL

AT THE WELL SITE the scraper is applied by a crew member using any simple tool, such as screw driver or tire iron. And . . . after applying a few scrapers a crew member gets the hang of installation and really moves along so that he installs quickly and efficiently one scraper after another.

TRIPLE SPIRAL
PARAFFIN REMOVERS

* IS NOT WELDED in any way.
* CAN BE SALVAGED and used again on new rods.
* Eliminates cost of rod handling and transportation to factory or shop for installation.
* Spaced for any stroke length.
* Will not slip if rod is stressed—tested for 2350 lbs. grip.
* Now in use in EVERY AREA where paraffin is a problem.
* Sizes available for IMMEDIATE DELIVERY to fit 5/8" to 1" rods in 2" to 3" tubing.

Distributed by Sucker Rod Manufacturers
AVAILABLE THRU YOUR SUPPLY STORES
MANUFACTURED BY
The TRIPPLEHORN CO. P. O. BOX 6326 DALLAS, TEXAS

Mud-Treating Procedures in Venezuela's Bolivar Field

(Continued from page 296)

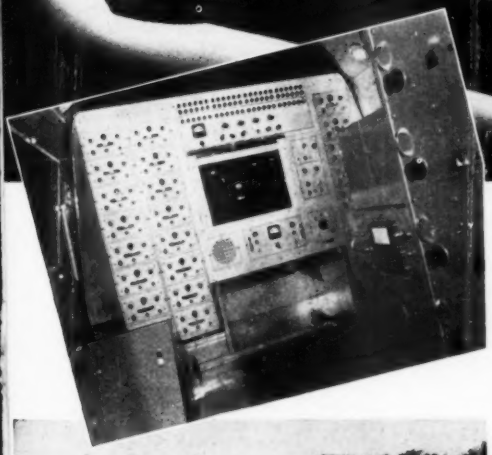
section. Daily mud treatment average 100 lb. of quebracho, 50 lb. of caustic soda, and 5-15 sacks of bentonite. The filtrate rate improves gradually during the drilling, reaching a value of 5.0-7.0 cc. in 30 minutes in the latter stages of the drilling.

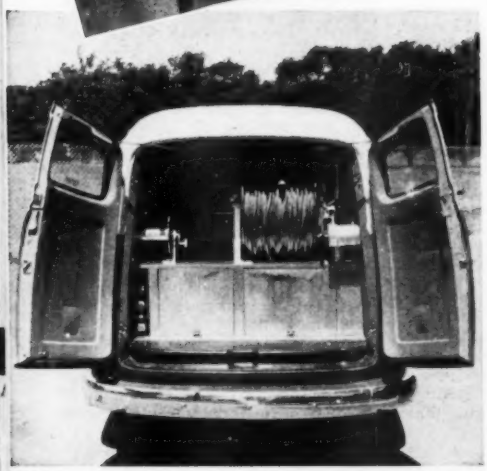
Eocene wells are usually completed without difficulty and normally make strong producers of the order of 1,000-3,500 bbl. of oil per day, indicating that the sands suffer no significant damage through exposure to the alkaline-tannate mud.

Lower Eocene and Cretaceous.—This interval has been penetrated by only a few deeper pool tests in Bolivar coastal field. Typically, the section below the Miocene consists of about 6,000 ft. of Eocene, 1,500 ft. of Cretaceous shales, and about 1,200 ft. of Cretaceous limestone. The Eocene can be drilled with an alkaline-tannate mud similar to that previously described; however, the Cretaceous shales are much more susceptible to swelling and sloughing in the presence of water and consequently require a lower-water-loss mud than is obtainable with the alkaline-tannate treatment. The following mud-treating procedure has been found to be satisfactory for the drilling of this interval:

Alkaline - tannate - treated mud is used for the drilling of the entire Eocene section. When the Cretaceous shale section is entered at between 10,000 and 11,000 ft., the mud is converted to a high-pH starch mud with a water loss of 2-3 cc. in 30 minutes. Even this relatively low-water-loss mud did not give adequate protection for the 1,500-ft. thick Cretaceous shale section in one recently drilled well, and it was necessary to add crude oil to form a starch-crude oil-emulsion mud. The addition of 10-15 per cent of 17°-A.P.I.-gravity crude to the high-pH starch mud further reduced the filtrate rate which prevented further sloughing of the Cretaceous shale interval. After setting casing through the shale section, the Cretaceous limestone was drilled to total depth of 13,841 ft. without further incident. No commercial oil production has been established in the lower Eocene or Cretaceous intervals of Bolivar coastal field to date.

SSC Now offers a Pilot Crew for preliminary surveys





The research division of SSC provides another "tool" for more accurate seismic exploration.

The new *laboratory on wheels* contains the equipment for a PILOT CREW to operate in new or extremely difficult shooting areas and in addition to conduct normal field tests. Its use will determine the proper instrumentation and field procedure to be used in an area by the regular seismic crew.

This unit should contribute to more accurate surveys as well as to effect economies in time and materials.

THE EQUIPMENT consists of —

1. **Standard 24 trace recording unit.**
2. **40 trace camera — permitting multiple recording.**
3. **Bank of 4 flat response amplifiers.**
4. **4 trace variable area recording camera (recording the output of the flat response amplifiers).**

In general, the test shooting will be carried out on a 12-trace geophone spread, with the additional amplifiers paralleled to allow the recording of two filter settings and mixing on each shot.

For laboratory study of the test shooting the records made with the variable area camera may be analyzed, when desired, with variable area reproducing equipment.

Seismograph Service Corporation

TULSA, OKLAHOMA, U. S. A.

Construction view of topping unit of Britain's Kent refinery, with distillation columns in center.

Third A.I.O.C. Refinery in U. K. Has Many New Features

A STUDY of a map of Great Britain shows that neither the Llandarcy nor Grangemouth refineries of Anglo-Iranian Oil Co. is well placed for the economic supply of products to London and the Southeast of England. This led to the decision to select a site in the Thames Estuary area, for an additional refinery to supply the company's expanding markets. A suitable site for a new refinery giving adequate deep-water frontage for ships was not available nearer than the Isle of Grain, which lies approximately 40 miles from London on the south side of the Thames at the confluence of the Thames and Medway estuaries.

The south side of this promontory which is bounded by the Medway River provides a good frontage with water sufficiently deep at all states of the tide to provide berths with 40-ft. depth of water suitable for the largest oceangoing tankers. There is a maximum tidal variation of 17-20 ft. at this location, and the berths are in sheltered water.

An area of about 2,000 acres in the selected vicinity was duly secured for the refinery site, of which 600 acres is now being developed. Most of this area is reclaimed marsh land below maximum high tide level from which it is protected by earthwork levees.

Concrete-Pile Foundations

Since the commencement of work in June 1950 the original plan for a 2-million-ton refinery has been extended to 4 million tons, though without change in the size of the lubricating-oil section. The interruption to the operations in the company's refinery at Abadan, Iran, has, of course, accentuated the demand for the rapid commissioning of this Kent project, and so emphasis is being put on bringing the plant into operation for the production of simple base products as soon as possible with the units required for the improvement of quality and for the production of lube oils, following in that order.

The scheme was sanctioned in June 1950 and it is expected that erection of all the plant envisaged will be complete by the end of 1953, with production commencing in June 1952 provided no serious shortages of material become apparent after the time of writing.

The following approximate quantities of materials will have been used in the project or handled in connection with it when it is completed:

70,000 tons of steel (excluding pipe lines); 38,000 tons of pipe; 40,000 tons of cement; 8,000 tons of reinforcing steel; and 12,000,000 bricks.

The low-lying refinery areas are profusely intersected with surface-water ditches of large area but little depth, which ditches have been cleaned out and filled in with gravel soil dug from the high ground of the original island. The total quantity of material moved for this purpose and for constructing embankments for roads and railways, and for tank bases and other earthworks will reach approximately 2 million cubic yards, and in addition to this nearly 1 million cubic yards of hydraulically placed sand fill has been dredged from a sand bank about 6 miles away in the Thames Estuary and pumped ashore into the lowest-lying areas at the southeast extremity.

Original Plans Enlarged

The alluvial mud of the marshes overlies a patchy deposit of gravel which in turn lies on a deep bed of London clay which latter has adequate bearing capacity to carry concentrated loads. The alluvium varies in depth from a few feet near the original island to 90 ft. at the site of the jetties. These considerations influenced the layout of the plant which has been arranged with the heaviest pieces of equipment situated near the good ground of the island where piling is not required, foundations being taken down to the London clay. Even so, a total of about 2,000 precast concrete piles varying in length from 15 to 70 ft. will be required for the whole job.

The main process units for the crude-oil section of the refinery consist of a large distillation unit of 80,000 bbl. per day capacity, two 17,000-bbl. per day vacuum distillation units and a catalytic cracker of 10,000 bbl. per day. Other minor plants include a gasoline stabilizer, a rerun unit, copper chloride treaters, an acid treater, and a tannin solutizer unit. Further plants for the improvement of quality and for special products, which are scheduled to follow, consist of a catalytic reformer, a catalytic polymerization plant, and an SO_2 treatment unit. A plant for the recovery of sulfur from the gases is under consideration.

Provision is made for the production and bottling of liquid butane and for loading refined products into tank trucks and tank cars.

The lubricating-oil section of the refinery will include a propane deasphalting process, a furfural-extraction unit, and M.E.K. dewaxing plant, and a clay-contact plant.

Power service for the refinery will be provided for the initial operating period by means of duplicate but independent 33,000-volt supply lines from the British Electricity Authority grid system, which will serve all purposes until such time as the refinery's own power station is completed, whereafter the supply from the grid

will be retained on a minimum off-take guarantee basis while the main load of the refinery will be taken by the new power station.

Generating plant will consist of two 5,000-kva. and two 3,000-kva. back-pressure steam-turbine-driven alternators generating at 11,000 volts and operating on a pressure of 550 psi. and 730° F. of superheat. One 5,000-kva. and one 3,000-kva. set will exhaust at a pressure of 250 psi. while the remaining pair will exhaust at 180 psi. The exhaust from the former pair will be fed to high-pressure water evaporators to produce pure feed water for the boilers while the latter will exhaust direct to the process steam mains.

Distribution from the generating station will be at 11,000 volts through a central switch house which will be a control house for the whole refinery; outwards from the central power control house the supply will be by 3,300 volts to substations and thence by 440-volt distribution cables laid in precast - concrete - covered ducts. As a general rule throughout the plant and area, lighting will be at 250 volt single phase and motors up to 50 hp. will run on a supply at 440 volt while motors over 50 hp. will use a 3,300-volt system.

Steam for the refinery will be generated in five water-tube boilers working at 560 psi. at the boiler stop valve and at 750° F. superheat. Process steam will be supplied at 150 psi. at the battery limits of each plant and will supply or supplement requirements of low-pressure steam in certain areas by a reducing valve. Steam will also be supplied at 225 psi. to the main cooling-water pump house.

Arrangements are made for supplying makeup steam at 150 psi. to the process main direct from the high-pressure side through reducing valves and desuperheaters, if circumstances arise when the pass-out steam from the generators falls short of refinery demand.

Fresh-Water Supplies

Fresh-water supplies for the refinery present a considerable problem in this area which is devoid of sizable fresh-water rivers within any practicable radius. The main supply will, therefore, come from a number of wells drilled for the purpose to an approximate depth of 800 ft. where the supply comes from deep chalk formations, and the water is consequently very hard.

Salt water for cooling purposes—of which about 4 million Imperial gallons per hour will be required on a 4-m.t.a. basis—will be obtained from the Medway Estuary and the system to be used at Kent incorporates quite an interesting feature. A new section of sea wall has been constructed to enclose a small bight on the foreshore thereby forming a reservoir of about 16 million gallons capacity. The reservoir will be filled by tidal action through balanced flap valves and contains sufficient water to keep the refinery running for the period between tides at the initial planned throughput of the refinery.

When, however, the refinery water demand increases, it will be necessary to augment the natural flow by pumping during low-tide periods; therefore a special pump house will be provided on a piled structure to support vertical spindle pumps which will automatically maintain the reservoir permanently at a predetermined level. The tidal intake will, however, save installation and permanent pumping costs to the extent of 350 hp.

The reservoir will also provide a quiescent pool for the deposition of silt before the water flows thence to the main refinery circulating pump house via a concrete-lined channel about 4,000 ft. long. The main pump house will be equipped with four steam-turbine-driven geared centrifugal pumps, each with a capacity of 1.5 million gallons per hour at a head of 150 ft. delivering through a system of buried steel mains up to 60-in. diameter which will be cathodically protected from corrosion.

Return of Cooling Water

Effluent cooling water is returned to the Medway Estuary at a point about ½ mile downstream of the intake through buried reinforced concrete mains of 88-in. diameter lined with a thin steel membrane which is protected internally with a 1½-in. thick gunited cement coating. Maximum design temperature of inlet water is 65° F. and effluent will leave units at a maximum temperature of 110° F.

The poor bearing quality of the ground would make the construction of large concrete A.P.I. oil-water separators prohibitively expensive. To avoid this, resort has been made to a novel method of construction of the separators. The oil-water separator system has been designed on A.P.I. lines, but it will consist of a series of steel tanks of which the bottom plates will be all welded while the side plates are of dished pressed-steel sections bolted together with the flanges turned inwards and protected with a gunite lining. Each of these tanks measures 80 by 40 ft. and is divided into seven compartments with a header tank at each end and fitted with baffles, skimmers, and sludge scrapers on conventional lines.

The area where the separators will be built has been reclaimed by pumping sand into the area to a depth of approximately 5 ft. which has been given time to drain out and consolidate; the separator tanks will stand on pads approximately 3-in. thick of a sand-bitumen carpet raised slightly above the surrounding ground level. The tanks are interconnected by means of flexibly connected pipes so as to allow for slight individual settlement of the various tanks and in the event of any considerable settlement of any tank or tanks, it will be possible to close off the tank for raising and repacking to correct elevation if this should ever become necessary.

The elevation of the top of the oil-water separators is such that it will enable water to drain to the Medway Estuary by gravity at all states of the tide, and to achieve this effect it is necessary to make the whole of the effluent system a closed one which will operate under 10-12 psi.

The bad ground conditions on the low-lying marsh land have made it necessary to raise all roads and rail tracks approximately 3 ft. above the existing marsh level in order to obtain an adequately strong formation under the roads. Surface pipe tracks will be run on precast reinforced concrete pipe supports which carry the pipes approximately 9 in. above the existing ground level, and wherever roads have to cross pipe tracks, a special form of precast concrete road bridge is utilized which was designed to save labor in the field and to save timber shuttering. Each unit of the bridge is factory made and the only field work required, apart from the assembly and grouting of the units of the bridge, is the provision of a reinforced-concrete base slab as a foundation. This type of construction suits this locality particularly well as there are a large number of precast concrete factories in the vicinity, while timber and labor are scarce.

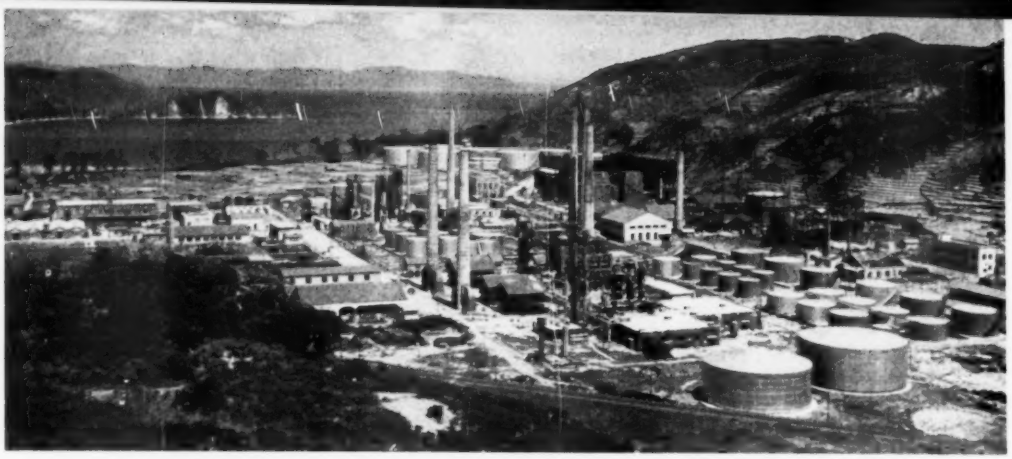
On most of the marsh land the height of oil tanks is limited to 24 ft. and all main tankage will be 144-ft. diameter; on land that has been reclaimed with pump-ashore sand, however, the height of tanks will be 30 ft. The main crude-oil storage area will be situated on the original Island of Grain where tanks of 144-ft. diameter by 60 ft. high will be used as the foundation conditions are good in that area.

Four Jetties Proposed

Four jetties are to be constructed, each capable of accommodating any size of craft from a 100-ton river barge up to a 32,000-ton ocean-going tanker at all states of the tide. The jetties are being built of steel box section piles up to 110 ft. in length and hearted with reinforced concrete placed after the piles have been driven into position. A separate special jetty will be constructed to handle lubricating-oil cargoes both in bulk and in package.

In addition to some 60 new storage tanks, the refinery will absorb approximately 50 tanks of a distribution depot which previously existed on the site belonging to the Medway Oil & Storage Co., Ltd.

Near the main entrance is situated the general office building and the central laboratory, the former being outside the main refinery fence while the latter opens direct into the refinery.



WAKAYAMA REFINERY TODAY.—Crude and products pipe lines run through tunnel under hill at right.

Japan Speeding Refinery Rehabilitation

War-inflicted damage is being repaired, and plants are undergoing general modernization

NEARLY 90 per cent of the petroleum products needed to meet current demand in Japan, still under postwar consumer rationing, are imported either as crude or as refined products.

Japanese refiners are making a determined effort to rehabilitate war-damaged plants and to modernize their equipment in order to minimize these product imports and to meet demand which is increasing despite government controls. Imports of crude for processing in Japan's refineries are also controlled. A general increase in these crude allocations has been another factor in plant- expansion programs.

Toa Nenryo Kogyo Co., Ltd., one of the major Japanese refiners, has engaged in an extensive postwar rehabilitation and modernization program which provides an interesting illustration of the progress achieved by the Japanese refining industry.

Toa Nenryo, of which Standard-Vacuum Oil Co. has been the majority stockholder since September 1949, owns and operates two refineries in Japan, both of which are on the main island of Honshu.

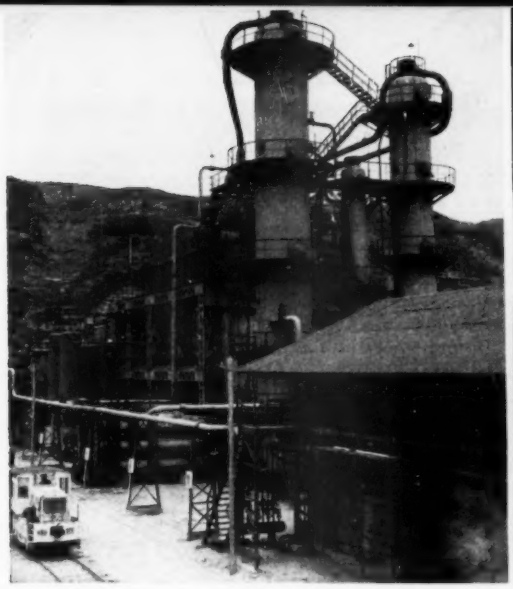
The smaller of these two refineries is at Shimizu, about 100 miles southwest of the Tokyo-Yokohama area on the Pacific Coast. Built in 1939, this refinery had suffered only minor damages when operations were stopped at the end of the war. The work required to prepare it for operations which were resumed in early 1950 consisted of the following main phases: (1) inspecting and reconditioning the existing equipment which had been idle for over 4 years; (2) revamping the distillation unit, previously in vacuum service charging a reduced crude, into a two-stage atmospheric and vacuum crude distillation unit; (3) completion of a benzene-acetone dewaxing unit which had been about 80 per cent completed in 1945.

Charged California Crude

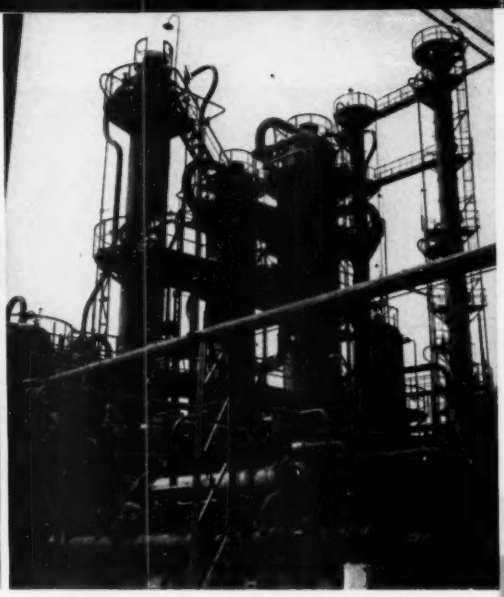
In February 1950, 5 months after rehabilitation work was started, the Shimizu refinery began charging imported California crude at a rate of 4,000 bbl. per day. Four months later in May 1950, the dewaxing unit, the last of the process units to be ready for service, began operation. The refinery is now charging 5,000 bbl. of crude daily, consisting of 3,000 bbl. per day of Arabian and 2,000 bbl. per day of California crudes. It produces a full line of fuel products as well as lubricating oils and asphalts which are marketed by Standard-Vacuum primarily in the Tokyo-Yokohama area.

The second and largest Toa Nenryo refinery is located on a 110-acre site in Wakayama Perfecture on the Pacific Coast, about 50 miles southwest of the Osaka-Kobe area. Construction of this refinery was also started in 1939, and it was operated continuously during the war until July 1945 when operations were terminated by severe bomb damage to tankage and principal operating process equipment, including crude-distillation and thermal-cracking units. The only major equipment in the refinery which escaped destruction during the July air raid were the boiler house, an uncompleted catalytic cracking

SHIMIZU REFINERY and surrounding area, 100 miles southwest of the Tokyo-Yokohama area.



WAKAYAMA.—View of 10,000-bbl. per day atmospheric crude pipe still.



WAKAYAMA.—View of thermal cracking section, showing fractionation and light-ends section.

unit, and harbor facilities. This equipment was the nucleus of the reconstruction program which was begun in September 1949.

The initial goal of the reconstruction work at Wakayama was to provide tankage, a crude-distillation unit, and light-oil-treating and gasoline-blending facilities in order that simple topping operations could be started as soon as possible. Tankage was largely rebuilt with reclaimed plates from damaged tanks which had been of riveted seam construction, and four 90,000-bbl. tanks were built with new material. Continuous gasoline caustic washing and doctor-sweetening units and agitators for kerosine treating were built from reclaimed material, and a new TEL blending plant was constructed. A 10,000-bbl. per day atmospheric crude pipe still was designed and erected utilizing a furnace, towers, and drums from the adjacent uncompleted catalytic cracking unit. Pumps, heat exchangers, and other parts were recovered from other bomb-damaged units, reconditioned and installed for service at the crude pipe still. This unit was completed and initial crude runs started in April 1950 at a rate of 6,000 bbl. daily, as limited by government crude allocation, with stream-day rates of 10,000 to 11,000 bbl.

During this phase of the Wakayama reconstruction work, process design of a thermal-cracking unit to charge 3,500 bbl. per day of topped crude was completed by Toa Nenryo engineers under supervision of an engineer from Standard Oil Development Co. The unfinished catalytic cracking unit also furnished such major equipment as furnaces and towers for this unit, construction of which began in May 1950. Two turbine-driven centrifugal hot-oil pumps and various control instruments were imported from the United States, and new furnace tubes were obtained in Japan. Construction was completed and the unit put into operation in March 1951.

Due to the critical shortage of lubricating oils in Japan, plans were made from the beginning to include lubricant-manufacturing facilities at Wakayama. Actual plant construction began in July 1950 on vacuum distillation and clay contact vacuum rerun units, as well as batch and continuous acid-treating equipment. Lube stocks were to be supplied principally from California crude which contained little or no wax. In addition, a bomb-damaged press dewaxing plant was rebuilt to process Saudi Arabian distillates for light-lube production as well as paraffin waxes, for which sweating, treating, and molding facilities were rehabilitated.

New Items Obtained

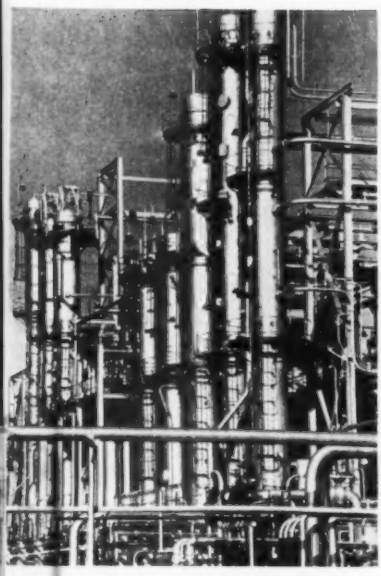
Although maximum use continued to be made of reclaimed and reconditioned equipment, it was necessary to obtain some new major items including one new tower for the vacuum distillation unit (a second tower was reclaimed from the old crude-distillation unit), a tower and rotary filters for the contact rerun unit, and three centrifuges for the continuous acid-treating plant. These units were completed and placed in operation beginning with the vacuum-distillation unit in November 1950, with the lube and wax finishing units following in early 1951. At this stage, the refinery was capable of processing 10,000 bbl. per day of crude into a full line of fuel products, waxes, and low and medium-quality lubricating oils. Actual crude rate, however, was limited at that time to 7,350 bbl. per day by government allocation.

A steady and growing demand exists in Japan for higher-quality lubricating oils. With a view toward meeting this demand, idle equipment was acquired for reerection at Wakayama as propane-deasphalting and phenol-extraction plants. The necessary design changes and additions were made under the supervision of an engineer from Standard Oil Development Co.

In order to complete this lubricant-manufacturing program, a new propane-dewaxing plant has been designed by Toa Nenryo engineers with S.O.D. supervision and assistance. When completed, the dewaxing plant will be the only process unit constructed from new material. Even in this instance, an existing building is being revamped to house the unit, and other salvaged material will be used where conditions permit.

The Wakayama refinery today bears little resemblance to the bombed-out refinery that existed from 1945 to 1949. Toward the end of 1952 it is expected that the last traces of bomb-damaged equipment will have been removed and either put to use in the reconstruction program or sold as scrap. In addition to the material reclaimed for use in present and proposed operations, over 2,000 tons of scrap iron and steel have been sold, and it is estimated that about 700 tons remain to be recovered.

The two Toa Nenryo refineries are now running a total of 13,500 bbl. per day of crude (5,000 at Shimizu and 8,500 at Wakayama) which represents about 25 per cent total crude processed in Japan. With the present capacity potential at Wakayama, together with future plans, these refineries are expected to maintain their position in the Japanese oil-refining industry.



Gas plant of cat cracking unit at Rotterdam which came on stream recently.

Map showing location of refineries of Royal Dutch-Shell group. Middle East crude will provide most of the total throughput.

Shell to Operate 30 Per Cent of Total European Refining Capacity

Here's a country-by-country breakdown of progress during past 5 years in rehabilitating and modernizing manufacturing facilities

DURING the last 5 years the Royal Dutch-Shell Group in Europe has been busily engaged in a major expansion scheme. Apart from all the new construction, extensive repairs were necessary to all of the war-damaged refineries situated on the mainland of Europe.

The expansion scheme introduced two new phases into the group's European activities, namely the large-scale distillation of crude oils, and an entry into the field of chemicals from petroleum.

The crude-oil scheme has been based on Middle East crudes. Collectively the new plants erected for this expansion include as major items 200,000 bbl. per day Sharp fractionation, 34,000 bbl. per day thermal reforming, and 50,000 bbl. per day fluid-bed catalytic cracking facilities. The figures quoted are the design capacities which in the case of the crude distilling has already been exceeded considerably. Apart from this new capacity additional capacity has been obtained by revamping existing equipment.

To give an idea of the influence of the group's activities in Europe, the group will be operating about 30 per cent of the total 1952-53 European refining capacity. A small portion of the intake will consist of indigenous crudes and of South American crudes processed for special quality reasons, but Middle East crude will provide by far the greater part of the total throughput.

BELGIUM

Ghent.—The group operates a 1,900 bbl. per day refinery at Ghent, processing imported topped asphaltic crude. The production includes straightrun and blown bitumens, lube oils, special mineral spirits, and grease.

FRANCE

Through its majority interest in Shell Berre the group operates three refineries in France in conjunction with Compagnie des Produits Chimiques de St. Gobain. The refineries are Petit Couronne on the banks of the Seine near Rouen, Berre l'Etang on the shore of the Etang de Berre near Marseilles and Pauillac on the Gironde 30 miles northwest of Bordeaux. The total crude-distilling capacity of these refineries is approximately 105,000 bbl. per day.

Petit Couronne.—This refinery started in 1929 processing 1,800 bbl. per day; by 1938 the processing amounted to 12,750 bbl. per day. During the war the refinery was extensively damaged, but after rehabilitation the capacity has risen to 35,000 bbl. per day.

The refinery is designed for processing Middle East and asphaltic-type crudes. The Middle East crudes are processed for straightrun gasoline, reforming naphtha, kerosine, gas oil, and a straightrun residual fuel. There is a reformer and a thermal cracking unit for increasing the quantity and

C-S NEW Luxury CONSTELLATIONS

NOTHING FINER! NOTHING FASTER!

FLY C&S direct to

CHICAGO & SOUTHERN AIR LINES

VENEZUELA!

CUBA — JAMAICA

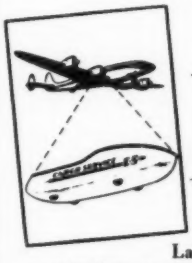
via

NEW ORLEANS GATEWAY

Flights each way Every day!

Fastest daily service from the Southwest! C&S New Luxury Constellations offer 300-m.p.h. pressurized cabin service to the oil fields of Venezuela and South America through the New Orleans gateway. One carrier service from Houston, St. Louis, Chicago and Detroit, with connections at New Orleans to and from New York, Dallas, Tulsa, Los Angeles and San Francisco. For reservations call the nearest C&S ticket office or your Travel Agent.

C&S NEW LUXURY CONSTELLATIONS OFFER FASTEST SERVICE BETWEEN HOUSTON AND CHICAGO; HOUSTON AND DETROIT; NEW ORLEANS AND DETROIT.



SHIP

C-S SPEEDPAK

Large SPEEDPAK units, carrying as much as most two-engine cargo planes, are attached to the 300-mile-per-hour C&S CONSTELLATION . . . providing a lower deck exclusively for cargo. C&S is the *only* air line operating SPEEDPAK service to Cuba, Jamaica and Venezuela!

CHICAGO & SOUTHERN AIR LINES

Offices in Principal Oil Centers in the United States

AXELSON

AXELSON FIRST CHOICE FOR

PETROLEUM PUMPING EQUIPMENT

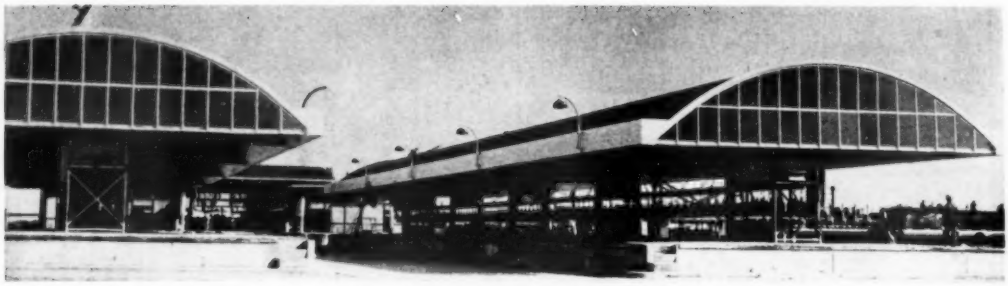
Axelson Sucker Rods deliver unquestioned reliability and assured performance under all well conditions.

ASK AN AXELSON EXPERT

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION

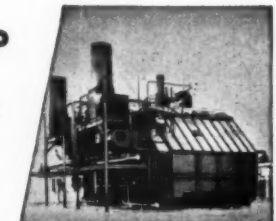
AXELSON MANUFACTURING CO. • PLANTS — Los Angeles 58; St. Louis 16 • OFFICES — New York City 7; Tulsa 1; Buenos Aires, Argentina; Caracas, Venezuela • DISTRIBUTORS — Jones & Laughlin Supply Co.; Great Northern Tool & Supply Co.; Industrial Agencies, Ltd., San Fernando, Trinidad, B.W.I.; Industries Waldrip & Campbell, Barcelona & Maracaibo, Venezuela; Dominion Oil Field Supply Co., Ltd., Calgary, Canada; South American Supply Co., Avenida Tacna 592, Lima, Peru.



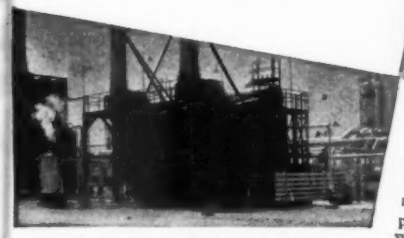
Filling installation for gas for industrial and domestic use at Rotterdam refinery.

WICKES

STEAM GENERATORS SPEED PROCESSING AND CUT COSTS IN REFINERIES AND NATURAL GASOLINE PLANTS

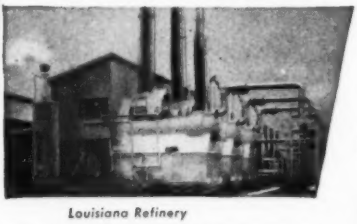


West Texas Natural Gasoline Plant

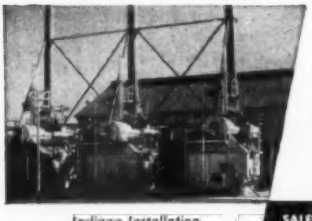


Central Texas Natural Gasoline Plant

The Wickes Type A Steam Generator is proving itself one of the most serviceable boiler units employed by the oil and gas industry. Wickes can fill your exact requirements for boilers of any type up to 250,000 lbs. steam per hour and 850 p.s.i. Wickes service facilities are world-wide and our knowledge of steam generation is available to you without obligation. Write for descriptive literature on the famous Wickes line of steam generators.



Louisiana Refinery



Indiana Installation

WICKES

THE WICKES BOILER CO. Saginaw, Mich.
Division of THE WICKES CORPORATION
RECOGNIZED QUALITY SINCE 1854

SALES OFFICES: Atlanta • Boston • Chicago • Cincinnati • Denver • Detroit • Houston • Indianapolis • Los Angeles • Milwaukee • New York City • Pittsburgh • Saginaw • San Francisco • San Jose • Springfield • Seattle • St. Louis • Tulsa • Mexico City • Buenos Aires • Manila • Havana • Montevideo • San Juan, P.R. • Victoria, B.C.

134

quality of the gasoline yield, which is refined in a doctor treater.

The gases obtained are used as refinery fuel, and for a very active L.P.G. trade.

The asphaltic crudes, usually of South American origin, are distilled in an atmospheric unit for the production of gasoline, tractor fuel, and gas oil. The atmospheric residue is vacuum distilled for the production of gas oil, a straightrun distillate, and a range of bitumen residues.

The straightrun distillate is refined for the production of conventional low-viscosity-index lube oils.

For the production of medium-viscosity-index oils there is a solvent extraction plant and also clay-treating facilities.

Various other smaller units include naphthenic acid recovery and special mineral-spirit distillation facilities.

Berre l'Etang.—The first year of operation was in 1931 with an average throughput of 1,000 bbl. per day and this had been increased by 1938 to 10,000 bbl. per day. The present crude-distillation capacity was increased to 63,000 bbl. per day in the summer of 1951 by the addition of a new crude-distillation unit.

The refinery is processing Middle East and South American crudes. The Middle East crudes are the source of gasoline, reforming naphtha, kerosine, gas oils, and fuel oils. The naphtha is reformed in a thermal reforming unit. As an aid to the tetraethyl lead saving the gasolines are sweetened by the Solutizer process. For the production of a high-octane-gasoline blending component there is a Houdry fixed-bed catalytic cracking unit operating on low-sulfur gas oil.

A certain amount of paraffin wax is manufactured from waxy distillate fractions by chilling, filtering, sweating, and acid treating.

A vacuum distillation unit is used for the production of bitumen and low-viscosity-index lube oil fractions from South American crudes. The lube oil fractions are acid and earth treated in the conventional manner, and there are facilities for the manufacture of medium-viscosity-index lube oils.

A new fluid-bed catalytic cracking unit is under construction.

The minor units include those for bottling liquid gas, kerosine acid treating, and special mineral-spirit production.

Pauillac.—This refinery, which had a capacity of 13,500 bbl. per day before the war, was totally destroyed by Allied bombing and the rehabilitation has virtually amounted to new construction.

The refinery has at present a crude-distillation capacity of 6,300 bbl. per day, other plants including a vacuum-distillation unit for the production of bitumen. The crude-distillation plant is now bein gextended to permit the processing of about 4,500 bbl. per day of Middle East crude, in addition to the South American and indigenous asphaltic crudes. The gasoline from the Middle East crude will be further refined in solutizer and acid-treating plants which are now under construction.

Besides imported crudes this refinery is handling an appreciable quantity of Lacq crude. This is a French indigenous crude, giving a high yield of bitumen, from a field in the south of France, at present producing at the rate of about 3,500 bbl. per day. It is hoped to increase this production to about 7,000 bbl. per day in the near future.

GERMANY

By the end of World War II the group's refineries in Germany were virtually inoperative. It was necessary to start rehabilitation from scratch, using the highest possible percentage of salvaged plant and material.

The refineries of Harburg, Grasbrook, and Wilhelmsburg are situated in the Hamburg district. Harburg, situated on the South Elbe with direct access to the sea, is the largest. It has an atmospheric topping and a vacuum unit for the production of gasolines, gas oil, lubricating-oil fractions, and bitumen from Middle East crudes. The gasoline fractions are sweetened by Solutizer-acid treating, resulting in a product with a high lead susceptibility. There are furufural extraction; solvent dewaxing (ethylene, methylene dichlorides); acid, low, and high-temperature clay contacting facilities for refining high-viscosity-index and medium-viscosity-index lube-oil fractions. All normal grades of bitumen are manufactured including blown bitumen.

Grasbrook is the center for grease production, lube-oil blending, the production of transformer, cable and other highly refined lube-oil fractions. As so much of this material is distributed in small pack form, Grasbrook has been made the center for packaging of finished products in drums, cans, and tubes. The construction of a modern grease plant for the production of sodium and lime-base greases is nearing completion.

Using gasoline fractions from Harburg, special mineral spirits are fractionated and treated in Wilhelmsburg.

The refineries of Monheim and Reisholz are situated on the Rhine River in the vicinity of Duesseldorf. Monheim has a capacity of 4,000 bbl. per day in which German and imported South American crudes are processed. The imported crude is supplied by barge from Rotterdam. The plant includes atmospheric and vacuum-distillation facilities for the production of gasoline fractions, gas oil, lube-oil fractions, fuel oil, and bitumen. The gasoline fractions along with hydrogenated gasolines are refined both in Monheim and Reisholz for the production of special mineral spirits and base materials of local chemical industries.

ITALY

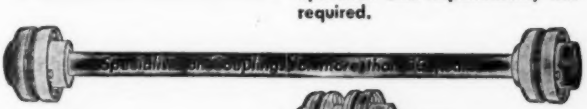
The group has a refinery in Italy at La Spezia near Genoa. The refinery has a crude-distillation capacity of 17,000 bbl. per day, which is being increased to 30,000 bbl. per day. Middle East crudes are processed for the production of gasolines, special mineral spirits, kerosine, gas oil, and fuel oils. There is a small thermal reformer for octane improvement. These reforming facilities have been obtained by revamping part of a former thermal cracking unit. The gasolines are doctor sweetened. During the construction of the extra

THOMAS *Flexible* ALL METAL COUPLINGS

FOR POWER TRANSMISSION • REQUIRE NO MAINTENANCE

REFINERS! PIPE LINE MEN!
DRILLING ENGINEERS!
LABORATORY TECHNICIANS!

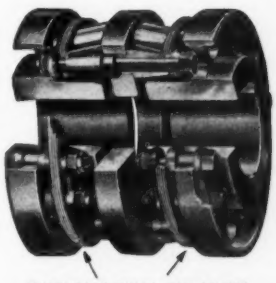
All can use Thomas Couplings to their advantage on Pumps, Compressors, Cooling Towers, Rigs or any tough job where continuous operation and dependability are required.



Patented Flexible Disc Rings of special steel transmit the power and provide for misalignment and end float.

Thomas Couplings have a wide range of speeds, horsepower and shaft sizes:
½ to 40,000 HP
1 to 30,000 RPM

BACKLASH
FRICTION
WEAR and
CROSS-PULL
are eliminated
Lubrication is not required!



PATENTED FLEXIBLE DISC RINGS

THE THOMAS PRINCIPLE GUARANTEES PERFECT BALANCE UNDER ALL CONDITIONS OF MISALIGNMENT.

• • •

NO MAINTENANCE PROBLEMS.

• • •

ALL PARTS ARE SOLIDLY BOLTED TOGETHER.

Write for the latest reprint of our Engineering Catalog.

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA

distillation capacity L.P.G. facilities will be added.

For the production of bitumen there is a vacuum-distillation unit operating on topped South American crude.

Rivarolo, near Genoa, is the center for transformer oil, white oils, and grease manufacture.

NETHERLANDS

Rotterdam-Pernis.—The Royal Dutch-Shell Group began construction on the present Rotterdam-Pernis site (situated on the south bank of the Nieuwe Waterweg) in 1934. At that time the refinery included crude-oil distillation, bitumen distillation with atmospheric and vacuum sections, a thermal cracking unit, gas processing, polymerization, and hydrogenation units. This complex was completed in 1937 and in 1939 the crude-distillation capacity was 20,000 bbl. per day as compared with the present capacity of 100,000 bbl. per day.

During the war the plant was at a standstill and suffered extensive war damage. After the war, an extensive and active program of rehabilitation and expansion was commenced. The major items of the expansion program are now completed, the last being a 25,000-bbl. per day fluid-bed catalytic cracker, which came into operation in the autumn of 1951.

There are three crude-oil distillation units operating mainly on various Middle East crudes with a combined total capacity of 100,000 bbl. per day. Slightly over half of the capacity is accounted for by the new distillation unit, which went into operation in 1950. These plants produce gasoline, reforming naphtha, light and heavy gas oils, and residual fuel oil. The thermal reformer of 8,500 bbl. per day capacity has been designed to operate over a wide range of severities and is quite capable of reforming a 35-octane number C.F.R.M.M. naphtha to yield a 70-octane number C.F.R.M.M. reformate.

The total vacuum-distillation capacity is in the order of 50,000 bbl. per day. Of this, part is used for lube-oil production from waxy feedstock. However, by far the greater part of the vacuum-flashed distillates together with straightrun heavy gas oil are used as feedstock for the 25,000-bbl. per day fluid-bed catalytic cracker. Part of the short residue is used to produce various grades of bitumen and the remainder is incorporated in fuel oils.

An indigenous Schoonebeek crude oil (24° A.P.I.) forms part of the charging stock for the 20,000-bbl. per day thermal cracking unit which can operate simultaneously under residue and coking conditions.

For the extraction of hydrogen sulfide there is a phosphate treating unit and new Girbotol facilities are under construction. A certain amount of the hydrogen sulfide is converted to elemental sulfur in a Claus kiln. The remainder is piped out of the refinery and sold. There are extensive facilities for treating, bottling, and bulk tanker deliveries of L.P.G. An appreciable quantity of the non-condensable gas fractions will be sold to the Rotterdam municipality to increase the supplies of town gas.

There are acid-treating and rerun facilities for treating the thermally cracked gasoline; the catalytically cracked gasoline is caustic washed and then, together with the straight-run reformate stream, is doctor treated.

The waxy lubricating-oil distillate fractions are dewaxed in solvent dewaxing unit (M.E.K.-Benzene). The dewaxed distillates are refined by acid and earth treating to produce medium-viscosity-index lubricating oils.

There are also facilities for the production of butylene polymers and special mineral spirits.

Near to Rotterdam-Pernis, at Maassluis, there is a small refinery, called Witol, producing transformer, technical white, and medicinal oils from imported feed stocks. Sodium naphtha sulphonates are recovered as a byproduct.

PASSPORT
for Petroleum Products
● Long before the turn of the century representatives of Charles Martin & Company had started building a reputation for dependable petroleum inspection. Now, petroleum products move unchallenged throughout the world on "passports" issued by Charles Martin & Company offices and laboratories. We invite inquiries to any of the strategically located offices . . . located to provide the best in petroleum inspection and tank calibration.
Chas. MARTIN & Company
New York, N. Y.
Boston, Mass.
Fall River, Mass.
Providence, R. I.
Tiverton, R. I.
Chicago, Ill.
Philadelphia, Pa.
Marcus Hook, Pa.
Paulsboro, N. J.
Bayonne, N. J.
Elizabeth, N. J.
Baltimore, Md.
New Orleans, La.
Baton Rouge, La.
Lake Charles, La.
Port Arthur, Texas
Beaumont, Texas
Houston, Texas
Baytown, Texas
Texas City, Texas
Freeport, Texas
Corpus Christi, Texas
Brownsville, Texas
Helena, Ark.
San Pedro (Port of Los Angeles), Calif.
San Luis Obispo, Calif.
San Francisco, Calif.
Tampico, Mexico
Havana, Cuba
Aruba & Curacao, N. W. I.
Trinidad, B. W. I.
Caripito, Puerto La Cruz
Las Piedras, Venezuela
Ras Tanura, Saudi Arabia
World's First Petroleum Inspectors

UNITED KINGDOM

In Britain, where before the war the group only processed intermediate feed stocks to bitumen and lube oils, the postwar years have been a time of great and rapid expansion, resulting in a total crude-distillation capacity of 170,300 bbl. per day, making the group the largest crude distiller in Britain. This capacity has been achieved by the construction of two new comprehensive plants next to existing refineries at Stanlow and Shellhaven and a major revamp of facilities at Heysham in 1948.

The group's refineries in Britain are at Stanlow (Cheshire), Shellhaven (Essex), Heysham (Lancashire), and Ardrossan (Ayrshire, Scotland).

Stanlow, the largest of the four refineries, can be divided into three distinct but closely related groups, Stanlow North, Stanlow South, and Stanlow chemical plant.

The group started operations in Stanlow North in the mid-twenties with a small bitumen plant. Since then this refinery has been expanded to a total capacity of 12,500 bbl. per day, combined asphaltic, paraffinic, and various mir or feed stocks.

The asphaltic feed stocks, topped South American crudes, can be processed in three vacuum-distillation units for the production of bitumen and a bulk lube-oil distillate. Bitumen blowing and cutback blending facilities are included. The bulk lube-oil distillate after fractionation can be worked up to conventional low-viscosity-index lube oils by acid and earth treatment. An Edeleanu plant has been incorporated in the scheme for the production of medium-viscosity-index-type lube oils and the preparation of transformer, technical white, and medicinal-oil feed stocks. For the production of the transformer and technical white oils there are continuous oleum treating and neutralizing equipment, followed by earth treatment.

For the production of high-viscosity-index lubricating oils there is a Duosol plant (Selecto: Propane) operating on an imported waxy residue feed stock. The Duosol raffinate is dewaxed in a solvent dewaxing unit (M.E.K.-Benzene), fractionated, and the various fractions finished by high-temperature clay contacting. The wax from the dewaxing plant is used as the feed stock for detergent production in the chemical industry (see below).

Various ancillary units in the refinery include bitumen blowing, special mineral-spirit distilling, and naphtha-sulfonate-recovery facilities.

Stanlow South is a completely new integrated crude-oil refinery with a rated total capacity of 74,300 bbl. per day of Middle East crudes. The refinery has been planned for the production of motor gasoline including a premium grade, gas oil, and residual fuel oils. The first of two distillation units went into operation in 1949 and the expansion program will be completed in 1952. A thermal reformer came into operation in 1950 and the second crude-distillation unit came on stream in 1951. A vacuum-distillation unit for the preparation of catalytic cracker feed stock is completed, and a 25,000-bbl. per day fluid-bed catalytic cracking unit will be completed early in 1952. Part of the short residue from the feed-preparation unit will be pumped to Stanlow North where it will be used as a bitumen feed stock in place of imported topped asphaltic crude.

The olefins from the thermal reformer and catalytic cracker gas streams will be used partly as feed stock for the chemical plant and the remainder will be polymerized for the production of polymer gasolines.

The gasoline and reformate are sweetened by doctor treating.

The hydrogen sulfide will be recovered in a Girbotol unit, at present under construction and converted into elemental sulfur in a Claus kiln. This sulfur will be a welcome addition to the economy on account of the world sulfur shortage.

Quite apart from the construction of the refinery, two other large engineering projects have arisen. For the cooling of the refinery process water the world's largest cooling tower, 341 ft. high, capable of handling 5 million gallons per hour, was completed in 1950. The large expansion in refinery capacity has also necessitated a similar expansion in tanker-berthing facilities. This is being done by Manchester Ship Canal Co. at Eastham, 7 miles from Stanlow. The group is building a tank farm just outside the dock area and connected to the refinery by a 16-in.-diameter pipe-line system. When all this construction work is completed, throughput will no longer be restricted to the current average rated capacity.

Shellhaven.—This plant, on account of expansion, really consists of two refineries.

Constructional work started in 1947 at Shellhaven West, the new refinery situated about 1 mile west of Shellhaven East, and was finished by mid-1951. This refinery consists of a 60,000-bbl. per day crude-distillation unit for the production of gasoline reforming naphtha, gas oil, and a fuel-oil residue from Middle East crude oils. The reforming unit is a duplicate of the one erected in Stanlow. Vacuum-distillation facilities are being erected for the production of a short residue. This short residue will be pumped to the East Refinery where it will replace imported topped asphaltic crude as a feed stock for bitumen production. The sour Middle East gasolines are sweetened by doctor treating.

At Shellhaven East, operations started back in the twenties. This refinery is now equipped with three vacuum-distillation units with a total capacity of 11,400 bbl. per day of topped asphaltic crude and operates for bitumen production. The bulk distillate is redistilled in a vacuum-distillation unit and the various lubricating-oil fractions are acid and earth refined to produce conventional low-viscosity-index-type oils.

For the production of high-viscosity-index-type lubricating oils from a waxy distillate feed stock there are furfural extraction, solvent dewaxing, (M.E.K.-Benzene), distillation rerun, and high-temperature clay-contacting units. There are facilities for continuous sweating of the slack wax from the dewaxing plant to product first-quality paraffin waxes.

Various other smaller units include bitumen blowing, special mineral-spirit distillation, and naphthenic-acid-recovery units.

Heysham.—In 1948 the group purchased from the British Government part of a plant constructed during the war for the production of aviation gasoline by the hydrogenation of gas oil.

The units have been revamped for distilling Middle East crude oils at the rate of 36,000 bbl. per day, producing motor gasoline, gas oil, and fuel oil. To improve the octane number of the gasoline a thermal reformer was built from available equipment, and to conserve gas oil a visbreaker was also constructed from idle equipment. What has been achieved in Heysham can definitely be considered as a marvelous example of adaptability.

The gasoline fractions are sweetened by hypochlorite treating. On account of the local availability of hydrogen a limited amount of imported selectively polymerized octylenes are hydrogenated for aviation gasoline component.

Ardrossan.—Ardrossan is a small refinery designed for local bitumen trade with a total capacity of 4,300 bbl. per day of topped asphaltic crude. At Barton, near Manchester, the group in conjunction with Anglo-Iranian operate a grease-making plant with a capacity of 123,000 lb. per day. In September 1951 a large modern lube-oil blending plant was also brought into operation.

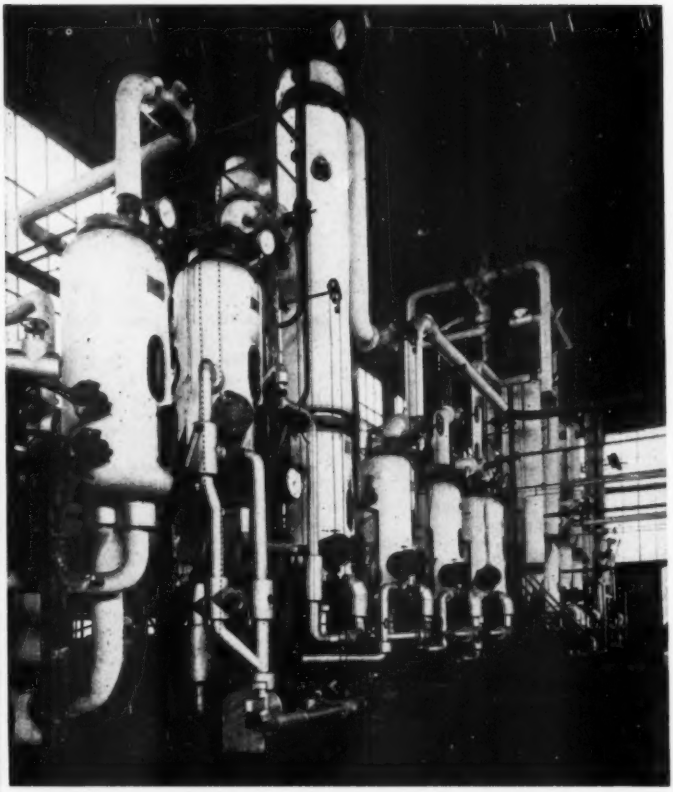
Petrochemicals

It is almost 10 years since the group made its first entry into the field of chemical industry in Europe. This was in 1942, at Stanlow, with a detergents ("Teepol") plant. Drum and spray drying units have meanwhile been added.

The demand for the detergent has been such that the erection in Pernis of a unit, which started production in 1949, was justified and another plant went on stream in June 1951 at Petit-Couronne in France.

In brief, the production of the detergents starts with the controlled cracking of certain wax fractions to yield olefins. A selected fraction of these olefins is sulfated, and the sulfuric acid esters are then neutralized with caustic soda. This neutral solu-

(Continued on page 332)



Solvent-recovery section of Edeleanu solvent-extraction plant at Manchester Oil Refinery. This plant is being enlarged to handle the larger output from the distillation plant.

England's Manchester Refinery Undergoing Expansion Program

Modernization and revamping extend from distillation unit to the power plant and the research department

THE Manchester Oil Refinery, Ltd., went into production in 1938 a few months before the outbreak of war cut off Britain from many of her established sources of vital petroleum products. A particularly serious loss was in the supply of high-grade lubricating oils, technical white oils, and transformer and switch oils, most of which were formerly supplied from Germany. It was fortunate timing that the Manchester refinery, which specialized in these products, was ready to maintain continuity in supply of these grades.

After the war, the government's policy in regard to home refining underwent a complete reversal and the country is now well advanced on its 300-million-dollar program for the construction and expansion of oil refineries in Britain within the framework of the OEEC Plan. It is thus in a very changed climate that the management of Manchester Oil Refinery, Ltd., has embarked upon its latest development program.

Distillation

The distillation unit originally consisted of a vacuum unit of 2,000 bbl. per day, and was installed for the distillation of a topped crude only. The advent of a natural crude containing small quantities of a light product necessitated the installation of a small stripper, which was more in the nature of a feed-preparation unit for the vacuum plant. It has been decided to replace this stripper, and now in course of construction is an atmospheric distillation unit designed to produce gasoline, white spirit, kerosine, and gas oil.

The effect will be to increase the capacity of the distillation plant as a whole from 2,000 to 3,500 bbl. of crude per day.

Edeleanu Plant

To keep the Edeleanu plant in line with the new rate of production the capacity has been increased by the installation of new solvent condensing capacity, increased solvent drying, and additional compression capacity. Yields have been improved considerably by exercising closer control over the temperature gradient on the extraction side. One new development which has had a great effect on maintenance was the installation in the early days of mechanical seals on the pumps, in place of the conventional stuffing boxes.

Power Station

Changes have been made in the power plant to effect a more economical use of the steam produced and to help to maintain the electricity supply during the difficult period now being experienced in this country.

Three separate steam pressure systems are maintained, the steam being generated at 300 psi., part of which is used for heating in the solvent plant. Originally a quantity was passed through pressure-reducing turbines driving cooling-water pumps which reduced the pressure from 300 to the 150 psi. used throughout the refinery process system. Any balance of production required in the 150 psi. system was passed through automatic pressure-reducing equipment. This pressure-reducing equipment was replaced by a double expansion reciprocating engine, driving an asynchronous generator set, excess steam automatically starting up the unit which again automatically was phased with the main supply, thus reducing the outside demand. The system was subsequently extended by installing another similar set using the steam which passed through the pressure-reducing turbines; water then had to be pumped by a separate electrical pump, but there was a gain in units available.

Chemical Treatment Plant

The original batch treatment of white oil and liquid paraffin was replaced in the early days by continuous units, then novel, giving close control over feed temperature, acid usage, and time of contact, separation being effected by centrifuges.

(Continued on page 332)

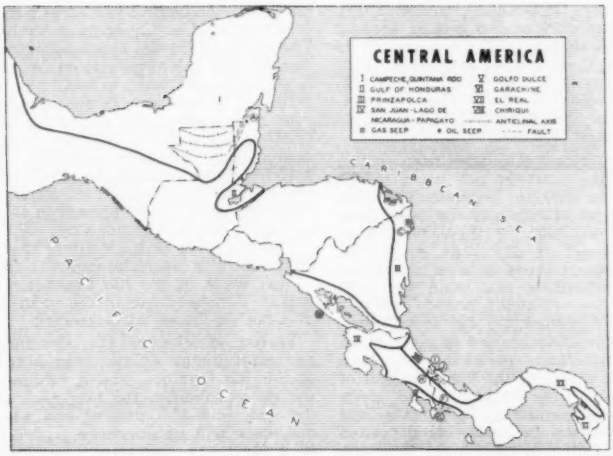


Fig. 1—Sedimentary basins of Central America are divided in eight areas, coinciding with the coastal lowlands.

Fig. 2—Garachine and El Real basins, Republic of Panama.

Petroleum Possibilities of Central America

by W. Farrin Hoover*

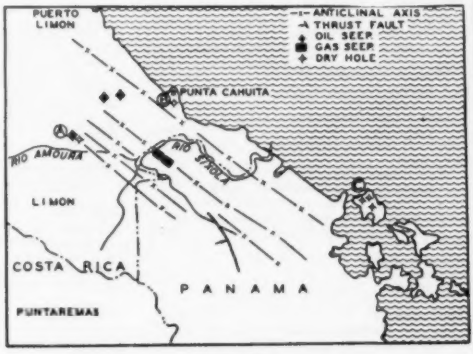


Fig. 3—Part of Chiriqui basin, Northeast Panama, and Southeast Costa Rica.

Exploration activity in this area is hampered by excessive rainfall and dense tropical vegetation which make geological work difficult and costly

A STUDY of the possible petroleum-producing areas of Central America shows that potentialities are related to the distribution of sedimentary basins or those areas in which marine sediments of Tertiary or Cretaceous age were deposited.

For the most part the eight areas outlined in Fig. 1 as sedimentary basins coincide with the coastal lowland areas of Central America. The elevation of these lowland areas ranges from sea level to a maximum of 1,000 ft. along the inner margin of the coastal lowland belt.

The low relief, and the position of these areas relative to the mountainous backbone of Central America impose a serious handicap on geological exploration. The over-all low relief makes surface work difficult. The abundance of rainfall and the consequent swampy character of the land surface together with the prevailing high temperatures and humidity are all factors that not only enervate scientific personnel but furnish the requisite conditions for a lush tropical type of vegetative cover that makes travel and geological work both difficult and expensive.

In every sedimentary basin discussed in this article the unconformities between many of the time units of the Tertiary system and the unconformity between Tertiary and Cretaceous systems have a tendency to obscure structure developed during the several orogenies that have affected Central America in the Mesozoic and Cenozoic eras. Careful and detailed sedimentary and stratigraphic studies must be made of these basins to determine the presence or absence of stratigraphic pinchouts and the possible presence of reservoir beds along the unconformities known to be present in most of the basin areas as outlined.

Careful and more or less detailed stratigraphic studies should be made in these basins in detailed surface reconnaissance work assisted by slim-hole drilling in areas of interest to determine the character of the subsurface stratigraphy and lithology. Geophysical prospecting will probably uncover subsurface structure suitable for the accumulation of oil and gas not apparent at the surface because of the unconformities in the stratigraphic section and locally by the cover of surface alluvium.

Campeche-Quintana Roo Basin (I, Fig. 1)

This sedimentary basin includes the states of Yucatan, Campeche, and

*Consulting geologist.

Quintana Roo of the Republic of Mexico, the northern portion of British Honduras, and the Province of El Peten of the Republic of Guatemala. The Central American portion of the Campeche-Quintana Roo basin is characterized by regional north dip of strata that range from Cretaceous to Pleistocene in age. Lower Cretaceous marine shales, marls, and sandstones of the Metapan series are exposed near the southern border of the basin in Guatemala. These beds should be present in the subsurface of the State of Yucatan, Republic of Mexico, beneath about 14,000 ft. of younger sediments.

The suggested stratigraphic section for the Campeche-Quintana Roo basin is given below:

PLEISTOCENE	
Marine sediments grading inland into fresh water-type sediments.	
PLIOCENE-MIOCENE	
Marine marls, clays, limestones and sandstones, ft.	5,300
MIOCENE	
Tenyapa formation	
Sandstones, shales, conglomerates with local development of marls and limestones, ft.	2,000
Sinjoel formation	
Marine marls, clays, and limestones, ft.	3,000
Rio Dulce formation	
Limestone, ft.	1,000+
EOCENE	
Sepur formation	
Red and yellow clays of marine origin; marls interbedded with sandstones, conglomerate and conglomeratic limestones, ft.	700+
CRETACEOUS	
Upper	
Massive limestones, dolomites, calcareous conglomeratic breccias, ft.	2,600
Lower—Metapan series	
Marine marls, shales, sandstones, and conglomerates with interstratified thin limestones	(?)
Total, ft.	14,300+

As may be seen from the above descriptions of the Tertiary sediments thought to be present under most of the Campeche-Quintana Roo basin area there are numerous beds that are capable of having both porosity and permeability. The marine origin of these beds makes all of them possible oil-bearing beds under the necessary stratigraphic and structural conditions that are known to be favorable for the accumulation of oil.

In northern British Honduras, a series of parallel faults with a northeast-southwest strike are present. Seepages have been reported near some of these regional faults (see A, Fig. 1). Arch-type folding, the Coban and Tekas arches with an axial strike of approximately east-west are present in the highland areas of the Campeche-Quintana Roo basin in southern Yucatan State of the Republic of Mexico. Cretaceous and Paleozoic axes of folding are probably present throughout this basin but are effectively masked by the Tertiary-Cretaceous unconformity. Seismic work and a certain amount of test drilling will be necessary to locate these buried structures. Sedimentary traps suitable for the accumulation of oil are probably present on the flanks of these buried structural features.

Two test wells have been drilled near the coast in this basin in the State of Yucatan, Republic of Mexico, one near Merida and the other near Progreso. Both of these tests were abandoned as dry. The geographic location of these tests in the Campeche-Quintana Roo basin was such that the sediments tested probably were deposited too far from shore, hence too fine grained to carry much porosity and permeability. Tests drilled closer to the inner margin of the Campeche-Quintana Roo basin should encounter more porosity and permeability in sediments deposited closer to the shore of a marine basin of deposition.

Gulf of Honduras Basin (II, Fig. 1)

The area underlain by sedimentary rocks of Tertiary and Cretaceous age in southern British Honduras and eastern Guatemala is considered as the Gulf of Honduras basin. The strata of this area are subdivided as follows:

PLEISTOCENE
Sandy clays and alluvium

MIOCENE
Todelo formation
Shale, sandstone, limestone, thinbedded diatomite
Rio Dulce formation
Dense white limestone

OLIGOCENE
Absent

EOCENE
Probably present but not described

No measured thicknesses are available for these strata but the possible total thickness of Tertiary-Cretaceous sediments is estimated to range from 2,000 to 4,000 ft.

Miocene strata are exposed at the surface in the Barranco upland of southern British Honduras. These strata are probably present beneath the Quaternary sediments in the vicinity of Lago de Isabel in eastern Guatemala. Where exposed in the southern portion of British Honduras, the Toledo and Rio Dulce formations are reported to contain bituminous material in the outcrops. Along the Temax River near Go-to-Hell Creek a distinct oil odor has been noted when these strata were broken by a hammer. In Guatemala, seepages from the Toledo and Rio Dulce formations have been reported from along the Rio Sarstoon and in the vicinity of Lago de Isabel. Cretaceous strata may be present beneath the Tertiary wedge edge in that portion of the basin that includes Lago de Isabel of Guatemala.

Structurally the British Honduras portion of the Gulf of Honduras basin is a system of highly complex faults. The structure of the Guatemala portion of this basin appears to be related to the eastward extension of a series of folded and faulted Paleozoic and Cretaceous mountains of relatively low relief. Tertiary sediments were probably deposited in a series of intermontane basins open toward the Caribbean. Sedimentary traps are likely to be present in this portion of the Gulf of Honduras basin.

The best area of the Gulf of Honduras basin in which to prospect for oil lies north of the Rio Sarstoon in British Honduras and in the vicinity of Lago de Isabel in Guatemala.

Surface studies of the structure and stratigraphy of the area north of the Rio Sarstoon should evaluate the oil possibilities for this part of the area. Slim-hole drilling and seismic work will be necessary properly to evaluate the petroleum possibilities of the Lago de Isabel area in Guatemala.

No test wells have been drilled in this basin.

Prinzapolca Basin (III, Fig. 1)

As outlined in Fig. 1 the Prinzapolca basin extends from Punta Patuca on the Caribbean coast of Honduras to Punta del Mono on the east or Caribbean coast of Nicaragua. Two distinct sedimentary basins are present within this large area, one centering on the Rio Coco or Rio Wanks that forms the international boundary between Nicaragua and Honduras, and one centering on the Rio Prinzapolca in the approximate center of the east coast of Nicaragua. As mapped on the geologic map of North America, Quaternary and Tertiary volcanics flank both of these distinct basin areas. Detailed work in the confines of the Prinzapolca basin will probably demonstrate that these volcanics are Pliocene in age and overlap older Tertiary strata which were deposited prior to the deposition of the marine Miocene beds mapped in the basins of the Rio Prinzapolca and Rio Coco (Rio Wanks). On the basis of the above reasoning the entire area outlined as the Prinzapolca basin is considered as a basin of sedimentation.

The lithology of the marine Miocene and Oligocene sediments in the two local basins mentioned above as appearing on the geologic map of North America apparently have not been described in detail in published material. Strata of Pleistocene age abut directly against deformed Cretaceous strata in the middle portion of the Rio Coco (Rio Wanks) area.

The structural trends of the mountainous portions of northern Nicaragua have an arcuate east-west trend. These trends were established at the end of Paleozoic time. The orogenic movements that occurred at the close of Cretaceous time probably

reactivated the structures formed by the earlier orogeny. These structural axes are continued beneath the Tertiary deposits of the Prinzapolca basin as a system of buried mountains.

This interpretation appears to be substantiated by the presence of granite at a depth of only 6,735 ft. in the American International Fuel & Petroleum Co. 1 Punta Gorda, total depth 6,735 ft. (B, Fig. 1). This well was drilled near the Caribbean coast of Nicaragua near the southern flank of the Rio Coco (Rio Wanks) subbasin. Late or post-Miocene tectonic movements probably deformed Tertiary sediments deposited in this basin. Thus structure and the possible pinchout of porous beds against the flanks of these buried mountains form reservoirs favorable for the accumulation of oil and gas in the Prinzapolca basin.

The presence of the buried structural trends mentioned above, the low surface relief, the presence of Quaternary sediments at the surface in most of the lowland area, and the relatively thick jungle-type vegetative cover throughout this basin make geophysical prospecting the only practical method to use in exploring the Prinzapolca sedimentary basin.

Two wells have been drilled on geophysical highs in Prinzapolca basin, the American International Fuel & Petroleum Co. 1 Punta Gorda, total depth 6,735 ft. in granite (B, Fig. 1), and the 1 Tawara, total depth 6,285 ft. (C, Fig. 1). Both of these tests drilled by the American International failed to find showings of oil or gas and were abandoned as dry holes. These two tests cannot be considered to condemn the entire area of the Prinzapolca basin when it is considered that the Rio Prinzapolca and Rio Coco (Rio Wanks) portions of this basin with a thicker sedimentary section than the locality in which American International drilled the two test holes have not been tested.

The Continental Shelf in the vicinity of the Miskito Cays should be considered as a favorable area for testing. Any structures that may be present on the Continental Shelf will of necessity need to be located by seismic methods.

San Juan-Lago de Nicaragua—Papagayo Basin (IV, Fig. 1)

The sedimentary area included in this basin consists of the Rio San Juan trough, the entire west coast of Nicaragua from the east side of Lago de Nicaragua to the Pacific Ocean, and the area around the Golfo de Papagayo in northern Costa Rica. The heart of the sedimentary outlined above is essentially that portion of Central America that was submerged during part of Tertiary time to form a seaway connecting the Atlantic and Pacific oceans. The sedimentation of the Tertiary strata in the confines of the San Juan-Lago de Nicaragua-Papagayo basin suggests a continuity of environment of sedimentation between the Atlantic and Pacific sides of the basin.

The stratigraphic sequence for the San Juan-Lago de Nicaragua-Papagayo basin is as follows:

QUATERNARY

Swamp deposits, cross-bedded sands, clay marls, alluvium, and volcanic ash. With the exception of the volcanic ash these sediments are unconformable on beds of Tertiary age.

TERTIARY

Upper Pliocene—Suretka conglomerate

Thick beds of cobbles of igneous rocks cemented by silica with local lenses of argillite and sandstone.

Upper and middle Miocene—Gatum formation

Blue or blue black sandstone, dark shales, sandy and impure limestones and marls, lignite and coal beds and occasional conglomerates. Coral reef limestones considered to mark the top of the middle Miocene appears in exposures near the coast. The lithology of the Gatum indicates that it has two facies, marine and littoral.

Lower Miocene—Uscari

Soft dark shales with some sandstones, limestones, diatomaceous limestone, and conglomerate. Purple mudstones, and coarse sandstones with volcanic ash are considered to be a facies of the Uscari in the Costa Rican portion of this basin. Limestones of Uscari age are also known as the San Miguel limestone.

OLIGOCENE

The upper or Oligocene portion of the Brito formation includes the following two series of strata:

Nicoya series

Marine facies of Upper Oligocene age. Coarse-grained sediments, principally volcanic ash and other detrital material, sandstones, limestones, and radiolarian cherts.

Manzanilla series

Volcanic debris, clastic sediments, and cream-colored limestone deposited in marine environment. The Manzanilla series are thought to be equivalent to the Nicoya series in time of deposition.

Guallava formation

Sandstones of Lower Oligocene age in Costa Rica. Thought to be of Lower Oligocene portion of the Brito.

Upper Eocene—Brito formation

Calcareous shales with beds of sandstone and thin coals all with much volcanic ash. In the eastern part of the basin these strata are beds of sandstone, conglomerate, and coarse volcanic breccias with beds of marl and lenses of pure limestone. Locally strata of Oligocene and Miocene age have been included in the Brito formation.

CRETACEOUS

Upper Cretaceous shales and sandstones with much volcanic material have been reported from western side of Lago de Nicaragua. These strata with a thickness of about 6,800 ft. have tentatively been correlated with the Mendez formation of Upper Cretaceous age in the Republic of Mexico.

On the basis of the origin of the various sediments present in the San Juan - Lago de Nicaragua - Papagayo basin, the Uscari formation of lower Miocene age offers the best possibility for production of oil and gas. Seepages in this formation appear to prove that it has producing possibilities.

In general the structures for this sedimentary basin on the west side of Central America and across the approximate center, show a marked tendency to parallel the northwest-southeast structural trends that form the mountainous backbone of Central America. Originally the Lago de Nicaragua portion of this basin was a synclinal area in which Tertiary sediments were deposited. This structural depression was bounded on the west by an anticlinorial axis of late Cretaceous-pre-Tertiary age. The structures either in the form of folds or faults have a tendency to parallel these major structural features.

The only known seepages in the San Juan - Lago de Nicaragua - Papagayo basin are those said to occur on the west coast of Nicaragua. These seepages have not been authenticated in the literature. It was probably on the basis of these reported seepages that the first well in Nicaragua or for that matter Central America was located on the west side of Nicaragua. This well, Miguel de Escoto 1 Cayetano (D, Fig. 1), was drilled to a total depth of 500 ft., a depth scarcely deep enough to evaluate the area, in the late twenties. No data is available as to the stratigraphy or the lithology of the strata penetrated by this test.

In 1935 Davis & Co. 1 San Rafael (E, Fig. 1), total depth 3,940 ft., was completed as a dry hole. This test was drilled in the vicinity of 1 Cayetano.

On the basis of the total depths to which these two wells were drilled, it is hard to believe that either of the two tests drilled on the west side of Nicaragua were drilled to a depth sufficient to test the producing possibilities of the west side of the San Juan - Lago de Nicaragua - Papagayo basin. Any well drilled to test the full sedimentary section of this basin should be planned as a 10,000-ft. test to evaluate the Upper Cretaceous strata.

Detailed surface reconnaissance work and a limited amount of slim-hole drilling will be necessary to evaluate the producing possibilities of the San Juan-Lago de Nicaragua-Papagayo basin.

Golfo Dulce Basin (V, Fig. 1)

The Golfo Dulce basin centers around the Golfo Dulce area on the Pacific side of southern Costa Rica and western Panama. The stratigraphic section for this basin is essentially the same as that given for the San Juan-Lago de Nicaragua-Papagayo basin.

Structurally the Golfo Dulce basin differs from the other sedimentary basin on the west coast of Central America in that it appears to be a sedimentary trough with the axis passing through the isthmuses that connect the peninsulas of southern Costa Rica and Panama with the mainland. The peninsulas appear to be the south and west flank of this

structural trough. Structures developed in this area have axial trends parallel to the axis of the sedimentary trough.

Two tests have been drilled in the Panamanian portion of the Golfo Dulce basin or trough, both in the vicinity of the town of David in southwestern Panama.

In 1925 The Texas Co. completed the 1 David as a dry hole at a total depth of 3,862 ft. No shows were reported from this well which was located on an anticlinal axis with a west-southwest strike (F, Fig. 1). In 1949 Sinclair Panama Co. drilled 1 Puerto Armuelles to a total depth of 9,715 ft. in basement (G, Fig. 1). This Puerto Armuelles test apparently penetrated the entire sedimentary section of the Golfo Dulce basin without encountering any showings.

Two tests in an area the size of the Golfo Dulce basin do not condemn the entire basin as prospective oil-producing territory especially since no mention has been made of the presence or absence of the Uscari formation of lower Miocene age which is considered to offer the best possibilities for production in the Golfo Dulce basin.

The mode of deposition of Tertiary sediments throughout this portion of Central America suggests that perhaps beds of Uscari age were eroded or never deposited over the structures tested by these two test wells. It could also be true that The Texas Co. 1 David was drilled too far updip on the landward flank of the Golfo Dulce basin to have found the Uscari deposited under optimum conditions for the accumulation of oil. Also that Sinclair Panama 1 Puerto Armuelles might have been located too far out in the basin to have encountered the Uscari with sands necessary for reservoir beds. The results obtained from the drilling of 1 Puerto Armuelles do show, however, that about 9,700 ft. of sediments are present in the Golfo Dulce basin.

No seepages have been reported from the Golfo Dulce basin but the known presence of the Uscari formation of lower Miocene age which is known to have seepages in other sedimentary basins suggests that this formation may eventually prove to be productive in the Golfo Dulce basin. Reef limestones in the Gatun formation of upper-middle Miocene age may eventually prove to have productive possibilities in the Golfo Dulce basin.

Garachine Basin (VI, Fig. 1)

The lowland area underlain by Tertiary marine sediments ranging from Eocene-Oligocene to Miocene in age surrounded by Tertiary volcanics in the vicinity of Garachine, Panama, has been designated the Garachine basin.

The marine Tertiary sediments of this basin while not exceptionally thick have a probable thickness of 5,000 ft. The stratigraphy of this basin probably is similar to that of the El Real basin or possibly the Golfo Dulce basin.

Showings of oil and gas, though noncommercial, were encountered in Panama Gulf Oil Co. 2 Garachine, total depth 3,059 ft. (B, Fig. 2), and slight shows were noted in 3 Garachine, total depth 4,986 ft. (C, Fig. 2). The 1 Garachine, total depth 3,250 ft. (A, Fig. 2) failed to encounter any showings of oil or gas.

All three of these tests drilled by Panama Gulf Oil Co. were located relatively near the coast in what is possibly the deepest portion of the Garachine basin. Structural trends known to be present in the Garachine basin strike approximately northwest-southeast. These structures are fold-and-fault-type structures which should serve as effective structural traps for the accumulation of petroleum.

The showings encountered in two of the three test wells drilled in the Garachine basin in 1924 suggest that the use of the newer methods of geophysical work and sedimentary interpretation as well as newer drilling techniques might result in finding commercial production in this portion of Panama.

El Real Basin (VII, Fig. 1)

The El Real sedimentary basin in a broad sense covers the central portion of southeastern Panama. It is the area in which marine Tertiary deposits are mapped. Structurally El Real basin is the area in the central portion of northeastern Darien Province of the Republic of Panama in which marine Miocene beds of Tertiary age are mapped. This basin, apparently a downwarped area in which marine Miocene beds are preserved, has been deformed by a system of folds and thrust faulting with a north-south strike formed by thrusting from the east. These structures appear to have been superimposed on a system of folds with a northwest-southeast-trending anticlinal axis.

From 1925 to 1928 Sinclair Panama Co. drilled three wells in the El Real basin (see VIII, Fig. 2). The 1 Yape, total depth 3,501 ft. (D, Fig. 2), is reported to have encountered about 200 ft. of cap and soft sandstone from 3,303 to 3,503 ft. Considerable gas and light oil were reported from this zone but with a salt-water flow (1,000 bbl. daily) in bottom of the sand. The presence of this salt-water flow led to the abandonment of this test.

The 1 Capeti (E, Fig. 2) was junked and abandoned at 995 ft., and 2 Capeti, total depth 3,000 ft. (F, Fig. 2), while thought to have reached the same stratigraphic horizon that had the showing in 1 Yape, was abandoned as dry without testing the remainder of the sedimentary section when it failed to find any shows of gas and oil in what was believed to have been the same stratigraphic interval that had the showings in the 1 Yape.

The showings encountered in 1 Yape and the failure to reach the basement rocks in the El Real basin in any of the tests drilled by Sinclair Panama Co. indicates that the El Real basin has possibilities for petroleum production. Intensive surface and seismic work in this basin will probably show that the sedimentary section has a probable thickness of 8,500 ft.

The exact stratigraphic sequence of the El Real basin does not appear in the literature. All of the detailed stratigraphic work in Panama has been done in the Panama Canal zone and in adjacent portions of Panama. The best estimate of the lithology and stratigraphic classification of the sediments of the El Real basin may be made by projecting stratigraphic column from the Pacific side of the Panama Canal zone into the area under discussion. This projected stratigraphic column is given below:

TERTIARY

Upper Miocene

Gatun formation
Sandstones, dark shales, sandy and impure limestones and marls, lignite and coal beds, occasional conglomerates, coral reef limestone.

Lower Miocene (probably equivalent to Uscari)

La Baca
Silty, sandy tuffaceous mudstones, flaggy calcareous sandstone, and limestone approximately 600 ft. thick.

Cucaracha
Bentonitic clay, minor carbonaceous lignitic shales, clayey siltstone, tuffaceous sandstone, and local thin pebble conglomerate.

Upper Oligocene

Upper Culebra
Three to ten feet sandstone grading laterally into sandy limestone with carbonaceous clays and fine bedded tuffs. Natural gas reported from scattered localities in this part of the Culebra.

Middle Culebra
Cream-colored coraliferous limestone locally called Emperador.

Lower Culebra
Dark shales with thin lignitic layers, marls, carbonaceous clays, tuffaceous clays.

Caimito
Tuff, agglomeratic Tuff, tuffaceous siltstone, and thin discontinuous beds of tuffaceous limestone with calcareous sandstone, siltstone. Limestone at base of formation.

Las Cascadas
Volcanic products, probably those around edge of volcanic pile. Thought to be stratigraphic equivalent of Camito formation.

Bohio
Massive poorly bedded conglomerate, tuffaceous sandstone and siltstone.

Eocene

Gatuncillo
Argillaceous sandstones and shales, mudstones, impure bentonite, and thin lenses of limestone.

The above stratigraphic section for the El Real basin is only an approximation. Variations in sedimentation in the form of interfingering of the various types of sediments in the individual formations suggests that per-

haps some of the thin sandstones in the Culebra in the vicinity of the Panama Canal zone are much thicker in the El Real basin. Also that many of the finer clastics of the section may be represented by coarser-textured ciastics in the El Real basin. The presence of natural gas in the upper or transition zone of the Culebra formation suggests that the showing obtained in the Sinclair 1 Yape (D, Fig. 2) may have been from the upper portion of the Culebra formation or its equivalent.

Chiriqui Basin (VIII, Fig. 1)

The area of Tertiary sedimentary deposits in Bocas del Toro province of the Republic of Panama and on the east coast of Costa Rica south of the Rio Chirripo are considered as having been deposited in a single basin of sedimentation. Marine Miocene sediments are mapped for this area, and Eocene-Oligocene marine sediments are probably present beneath the Miocene strata. Most of the seepages in Central America are reported from this area, particularly in that portion adjacent to the Costa Rican-Panamanian boundary.

The approximate stratigraphic column for the Chiriqui basin is given below:

QUATERNARY
Unconsolidated sand and clay.

TERTIARY

Pliocene
Crossbedded unconsolidated clays and sands; coral limestone forming the more prominent headlands along the Costa Rican coast.

Miocene

Suretka
Thick beds of pebbles, cobbles, and some andesite boulders. Locally, thin lenses lignitic shale. Unconformable on Gatun.

Gatun
Near-shore facies (at landward margin of basin): sandy beds with lignite and conglomerate.
Offshore facies (at seaward margin of basin): Coralliferous limestone and fossiliferous marl. Gatun formation unconformable on Uscari and thickens northward into San Juan trough.

Uscari
Shale with intercalated limestone and sandstone. Sandstone at top of formation. Thickness of Uscari in Chiriqui basin 2,000 ft.

Eocene-Oligocene
Sandstone, shale, and hard semicrystalline limestone which grades into coarse arkose considered as Eocene-Oligocene with preponderance of evidence favoring Oligocene age. Limestone becomes more argillaceous at top and appears to grade without distinct lithologic break into Uscari above.

Oil and gas seepages have been reported from the Uscari formation of Miocene age in southeastern Costa Rica. Gas seepages are reported from an area underlain by both the Gatun and Uscari formations of Miocene age along the Rio Zahorkin in northeastern Panama (J, Fig. 1). The show of gas at about 800 ft. in Costa Rica Oil Co. (Sinclair) 1 Cahuita, Costa Rica, may have come from a porous and permeable member of the Gatun formation.

The Chiriqui basin is characterized by the presence of northwest-southeast trending anticlines. These structures with dips of from 80° to 15° have more structural relief along the inner margin of the basin and are generally with lower structural relief and less tightly folded closer to the seaward or coastal margin of the basin. A thrust fault with thrusting coming from the south and west has been mapped near the southwest margin of the Chiriqui basin in Bocas Del Toro Province of Panama. Faulting is probably present in the Costa Rican portion of the basin but no mention has been made in the literature of thrust faulting being present in eastern Costa Rica.

The most important seepages in the Chiriqui basin are along Uscari Creek approximately ¾ mile above the junction of Uscari Creek and the Rio Amoura, 2½ miles north of the town of Suretka (H, Fig. 1). In this locality the seepage amounts to about 4 to 6 qt. of 23.5°-gravity oil per day from steeply dipping strata. The oil apparently reaches the surface along fault planes. Scattered seepages have been reported associated with faults in the valley of the Rio Estrella (I, Fig. 1). Seepages of inflammable gas occurs along the Rio Zhorkin for a distance of about 3 miles upstream from the junction of the Rio Zhorkin and the Rio Sixaola (J, Fig. 1), in the Republic of Panama.

Seven test wells have been drilled in the Costa Rican portion of what is considered to be the deepest part of the Chiriqui basin, and three in the Panamanian portion. The locations of these tests are shown on Fig. 3. In 1915 National Petroleum Co. drilled a test on Pinto-Greulich concession in the vicinity of the seepages along Uscari Creek in southeastern Costa Rica (A, Fig. 3). The 1 Pinto-Greulich was abandoned as dry at 800 ft. after finding no showings of oil.

In 1916 Costa Rica Oil Co. took over Pinto-Greulich concession from National Petroleum. In the period 1916-1920 Costa Rica Oil drilled four test wells on this concession near the seepages along Uscari Creek to a maximum depth of 1,400 ft. No shows were encountered in any of these test wells. In 1922 Costa Rica Oil acquired a concession in the vicinity of Punta Cahuita and drilled a test well, the 1 Cahuita to 3,862 ft. (B, Fig. 3). This well blew out and caught fire at 822 ft. but since no commercial showings of oil were encountered in this test it was abandoned as a dry hole.

The Panamanian section of the Chiriqui basin has had three wells drilled to test the productive possibilities of a structure located by seismograph along the coast of Bocas Del Toro Province. All three of these tests were drilled by Sinclair Panama (C, Fig. 3). One well was junked and abandoned at 1,625 ft. The second well was drilled to a total depth of 3,325 ft. and abandoned as dry after reporting no showings of oil. In 1949 Sinclair Panama drilled 1 Bocas Del Toro to 8,000 ft. No worth-while showings of oil or gas were found in this test well.

The presence of seepages of oil and gas in the Chiriqui basin and the presence of gas at 800 ft. in sufficient quantity to cause a well to blow out in the vicinity of Punta Cahuita in Costa Rica indicates that this basin is worthy of continued exploratory efforts, especially in the light of the presence of about 8,000 ft. of marine sediments in the coastal portion of this basin.

Summary

Central America has favorable areas in which to prospect for oil in the various basins outlined above. However, favorable concession terms must be available before exploration for oil can be economically feasible.

Favorable concession terms may be obtained under the existing conditions for the granting of concessions in Panama, Costa Rica, Nicaragua, and British Honduras. Several provisions in the petroleum law for Guatemala are not conducive to bringing risk capital into that country for petroleum exploration.

The laws of the Republic of Mexico forbid the granting of concessions to foreign-owned companies, but deals can be worked out with Petroleos Mexicanos on the basis of a cost-plus contract whereby the contractor undertakes to assume the risks of wildcatting and, if successful, is reimbursed for his capital outlay from the sale of the oil produced to Pemex, and obtains a profit from a negotiated percentage of the new production.

Conclusion

Eight basins of sedimentation are present in Central America in which marine sediments of Tertiary age were deposited. Orogenic movements in Tertiary and post-Tertiary times have formed structures favorable for the accumulation of oil in all of these basins. The deposition of Tertiary sediments over pre-Tertiary structure forms conditions suitable for the formation of stratigraphic-type traps in which it is possible for oil to accumulate.

Four of these basins have indications of the possible presence of oil in commercial quantities in the form of showings obtained in test wells that have been drilled or in the form of oil and gas seepages on the outcrop of possible producing strata. The factors favoring the individual basins discussed above are summarized below:

Campeche - Quintana Roo basin (Guatemala, Mexico, British Honduras): 14,000 ft. of Tertiary and

Cretaceous marine sediments present. Structure known to be present at surface and buried beneath unconformities in the section. Seepages reported in British Honduras.

Chiriqui basin (Panama and Costa Rica): 8,000 ft. of Tertiary marine sediments present. Structures known from surface and geophysical work. Gas encountered in test well in Costa Rica. Seepages present: Oil in Costa Rica, gas in Panama.

El Real basin (Panama): 8,000 ft. of marine Tertiary sediments present. Gas and oil show at 3,300 ft. in test well. Structure known to be present from surface work in the basin.

Garachine basin (Panama): 5,000 ft. probable maximum thickness of Tertiary marine sediments. Showings of gas obtained in 4,900-ft. test well. Structure known to be present.

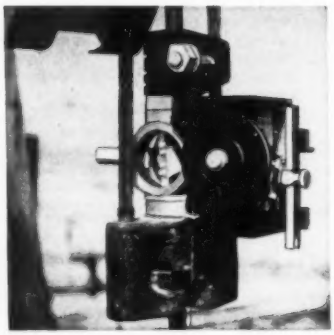
Golfo Dulce basin (Panama-Costa Rica): 9,700 ft. of Tertiary marine sediments present. Structure mappable at surface, and buried structures present. No seepages reported in this basin. No showings obtained in two tests wells drilled in this basin.

San Juan-Lago de Nicaragua-Papagayo basin (Nicaragua-Costa Rica): 8,000-10,000 ft. of Tertiary marine sediments. Structure favorable for accumulation of oil indicated at surface and may be present beneath unconformities in stratigraphic section. Unauthenticated seepage reported from western Nicaragua. Two test wells drilled near seepage reported no showings at a total depth too shallow to completely test stratigraphic section.

Prinzapolca basin (Nicaragua): 6,700 ft. of Tertiary marine sediments present. Buried pre-Tertiary structures with axial trends at right angles to axis of basin present. No seepages reported for this basin. Two test wells failed to encounter showings but proved presence of marine Tertiary sediments to 6,700 ft. and presence to buried structures.

Gulf of Honduras basin (Guatemala and British Honduras): 2,000-4,000 ft. of marine Tertiary and Cretaceous strata probably present. Seepages occur in British Honduras. Structure favorable for accumulation of oil present.

KNOW THE FACTS
About Your Pumping Wells
with J-F DYNAMOMETER



In the Refining processes, every step is controlled by scientific instruments. Yet with pumping wells, which produce about 90% of the nation's oil, very little instrumentation is used. One of the reasons for this has been the absence of an instrument that is easy to operate. The J-F Dynamometer may be operated successfully by non-technical personnel.

INCREASE PRODUCTION WITH OPERATIONAL CONTROL

The J-F Dynamometer reveals poor counterbalance; enables checking of pumps at surface; reduces number of sucker rod failures by determining peak load, range of load, and character of load; and aids the operator in selecting proper equipment. Decreased downtime and fewer pulling jobs mean more production at less expense.

JOHNSON-FAGG

Engineering Company

3920 South Peoria — Tulsa, Oklahoma

Drilling and Producing In Abqaiq Field

(Continued from page 200)

second lost-circulation zone, the next 2,500 to 3,000 ft. to the top of the oil-bearing horizon would be drilled with water. A string of 7-in. casing would be cemented in anhydrite immediately above the oil-bearing D member. Mud would be used again in drilling the last 200 ft., but would be replaced by water and a floating mud cap if circulation were lost.

The well would be completed with open hole through the producing section. A string of tubing would be hung near bottom to keep the hole clean.

These techniques have effected marked improvement in Aramco's drilling performance and have been important factors in speeding Abqaiq field to its present production level.

Producing Formations

Abqaiq oil is obtained from limestone (probably of Upper Jurassic age) interbedded with bodies of anhydrite. These same formations are well recognized in the majority of Saudi Arabian oil fields, and are known as the Arab zone. The layers of anhydrite divide this zone into four members known from top to bottom as A, B, C, and D. Commercial production in Abqaiq field is found only in the C and D members; and the C member is relatively unimportant. It is productive only near the top of the structure in an area some 9 miles long by 2½ miles wide.

The D member of the Arab zone is the primary source of Abqaiq's oil and is productive over the entire area of the field. The oil-bearing limestone, the major portion of which is either oolitic or dolomitized, extends through a total interval averaging 210 ft. Minor portions of this thickness are not productive. Permeabilities in the oil producing rock are extremely high—so high that cir-

QUICK POSITIVE SHUT-OFF

On natural gas, water and compressed air, 158 A.C.F. Plug Valves from 1" to 20" sizes at N. Y. State Natural Gas Compressor Plant.

On oil or gas control lines... for fast, easy, quarter-turn closing... no other valve can do the job like A.C.F. Lubricated Plug Valves. And the A.C.F. CYLINDRICAL Plug, being untapered, does not wedge in its seat. For quick, positive shut-off use A.C.F. Valves.

A.C.F. CYLINDRICAL FULL PIPE AREA **PLUG VALVES**

Representatives in 50 Principal Cities

Ask for Catalog 4-OG, American Car and Foundry Company, Valve Division, 1501 East Ferry Avenue, Detroit 11, Michigan

culation has been lost in a number of wells high on the structure, during the process of drilling through this section. Well productivity indexes have averaged between 150 and 200 bbl. per day per pound drawdown, although the oil-bearing rock penetrated by a few wells permits oil to flow with such slight restriction as to prevent reliable P.I. measurements. Cores recovered from these rocks have shown vugs large enough to accommodate the end of a finger; and the drillers have reported that in a few cases the drilling bit has dropped through apparent cavities up to 3 ft. Production from these portions of the reservoir takes on some of the aspects of drawing the oil from the tank.

Production History

In 1945, Aramco's construction forces were battling the ever-present handicap of procurement, trying to locate the material needed to bring Abqaiq oil to market. During the latter part of the year, a combination 12-14-in. pipe line was hurriedly laid from Dhahran across the 38 miles of salt flat and dunes. Three of the five completed wells were connected by flowing lines to a central point that eventually would be occupied by a 4-million-dollar gas-oil separator station. The first of the horizontal separators reached the field in December. It was small compared to present standards: only 4 ft. in diameter and 60 ft. long, capable of operating at 500 psi. It was jacked up on wooden blocks, fitted with makeshift controls, and connected to the three flow lines and to the main pipe line.

No one was sure what would happen when the oil and gas effluent from 500-lb. separation was turned loose through 38 miles of pipe line undulating over sand dunes and rocky ledges and ending in a Hortonsphere designed to operate below 10 psi. The experience was not as alarming as some people had anticipated, but it was exciting enough, with operators dashing along the line to adjust the gas bleeders placed at high points on the dunes.

As all Abqaiq gas is sour, and therefore is burned as a safety precaution if released to the air, each bleeder supported a flame. Across the miles of desert, these flaming points marked the position of one of the world's longest gas-oil separators. For a period of about 2 months, until pumps and additional vessels could be installed, three Abqaiq wells delivered between 20,000 and 30,000 bbl. of oil daily by their own energy, over distances averaging in excess of 40 miles—which should receive at least honorable mention in flow-line performance.

Abqaiq's production climbed steadily from early 1946 to early 1949, the increase being governed chiefly by the speed with which wells could be drilled and separator stations, pumps, and pipe lines installed. In January 1949, daily production averaged over 400,000 bbl. daily from 36 connected wells. Decreased oil demands lessened the field's output during 1949 and early 1950, but in May of the latter year, the demand was back again, and the rush to install oil-handling facilities was renewed. In April 1951, the sixty-first well was connected to a separator station. In July of the present year, the yield produced an average of 570,000 bbl. per day, which probably will be near to the maximum output as limited by oil handling facilities.

Today the field is equipped with three gas-oil separator stations, two on the main anticline and one in the northern area (see Fig. 1). Wells are connected to these stations by high-pressure flow lines averaging somewhat less than 3 miles in length, but reaching a maximum of over 6 miles. The flow lines total approximately 164 miles of 4, 6, and 8-in. welded pipe designed to hold the full surface pressure of the wells, which was nearly 1,500 psi. initially. This installation alone constitutes an important pipe-line system.

The separator stations are not uniform in capacity, as the various units represent considerable development in design from the first to the most recent installation. The newer units contain the following major items:

Two horizontal separators (for first and second-stage separation), 6 ft. in diameter by 120 ft. long.

One horizontal separator (for third-stage separation) 9 ft. in diameter by 120 ft. long.

One Hortonspheroid of 10,000-bbl. capacity. (Provides emergency oil storage and fourth-stage separation.)

Battery of gas-turbine-operated shipping pumps.

Such a unit is capable of handling about 140,000 bbl. per day through four stages of separation usually performed at pressures of 500, 250, 45, and 5 psi. A total of five units are installed at the three stations—two at Station 1, two at Station 2, and one at Station 3. Each station also contains a separate unit for testing and gaging individual wells. Three stages of separation are provided in the test units, at 500, 50, and 5 psi. A Hortonspheroid provides the last stage and also acts as the gage tank.

As previously mentioned, Abqaiq oil is sour; therefore, the portion shipped by tanker must first be treated in stabilizers to remove hydrogen sulfide. The Abqaiq stabilizer plant can treat 500,000 bbl. daily of oil which has a shipping gravity of 36.8° to 37.7° A.P.I.

Space will not permit a comprehensive discussion of Abqaiq's reservoir performance. Moreover, 5½ years of production history on so vast an oil accumulation has not provided the answers to many reservoir questions. Abqaiq is still a young field.

During the early stages of production, Abqaiq wells habitually produced in the magnitude of 17,000 bbl. daily. The average well still is able to deliver about 10,000 bbl. daily to the first stage of separation at 500 psi.

Aramco plans to spend 20 million dollars in constructing a major gas-injection plant to assist Abqaiq's natural water drive in maintaining pressure. The project is scheduled for completion during 1953. With the assistance of this pressure-maintenance program, Abqaiq wells are expected to flow for an indefinite number of years, possibly to or near the point of exhaustion.

Aramco is in the process of developing other large fields in Saudi Arabia, fields that within the next year should attain major importance in the company's production program. Other names will appear more frequently in production discussions: Ain Dar, Uthmaniya, Haradh—to name a few. But there is small chance that any other field will play so vital a part in Aramco's growth as that found beneath the drifting sands of Abqaiq.

New Petrochemicals Plant

(Continued from page 203)

of the total gas used in the Manchester area.

Ethylene Synthesis

The ethylene from the gas-separation plant supplies a conventional plant for making ethylene oxide by the chlorhydrin process.[3]

Behind these towers are situated the saponifiers where, by the introduction of milk of lime and steam stripping, the ethylene oxide-water vapor is produced, and subsequently fractionated in the towers shown in Fig. 4. The ethylene dichloride batch still can be seen in the left foreground.

The ethylene oxide is stored in tanks under an atmosphere of nitrogen and refrigerated by the circulation of cooled ethylene glycol solution, in order to avoid the dangers of auto-polymerization.

A small quantity of ethylene oxide is sold as such but most of it is used in the manufacture of ethylene glycol, ethanolamines, and ethylene glycol ethers, for which synthesis plants have been built.[4] The ethanolamines are produced by reacting aqueous ammonia and ethylene oxide in a continuous process working at high pressure, the products being separated by fractional distillation. The glycol ethers are made in a similar way by reacting the ethylene oxide with various alcohols, and already glycol ethers have been made in quantity from the methyl, ethyl and butyl alcohols.

Propylene synthesis.—Propylene from the gas-separation plant is converted into isopropyl alcohol by the

normal sulfuric acid process. The concentration of weak acid arising from this process is carried out by means of submerged fuel-gas combustion in a very compact, efficient, and clean plant designed by Nordac, Ltd.[5]

At the present time, mixed C.'s are bottled and used as liquid gas. Future developments will certainly include new plants to utilize this fraction more profitably.

Liquid Product Treating

The first link in the chain of liquid process plants is the primary distillation, separating the crackylate into its crude fractions. This consists of a conventional atmospheric distillation unit. The light oil and topped light oil are then redistilled in a series of towers shown in Fig. 5 yielding crude benzene, toluene, meta- and para-xylene, and ortho-xylene and styrene. The nonaromatics in the crude benzene and toluene boiling range are removed by azeotropic distillation with methanol as the entrainer[6] leaving the products, which, after chemical treatment and rectification, yield the final nitration grade of benzene and toluene. Some of these columns are 110 ft. high and have as many as 42 plates and work either at atmospheric or reduced pressure. All these distillation processes are continuous and fully automatically controlled.

Alkyl benzene.—This fraction, with a boiling range of 150°-190° C. (302°-374° F.) contains about 35 per cent of material, which, after polymerization, yields a pale lemon-colored transparent resin having a softening point which can be varied between 90° and 115° C. (194° and 239° F.). This resin is in great demand in the paint and varnish industry. The plant making this resin has been already extended to extract similar products from other Catarole fractions.

Although the styrene present in the xylene fraction cannot be separated as such, it can be copolymerized with various liquid and solid materials to make various paint media and rubber-like products. A plant has been built for this purpose for Styrene Co-Polymers, Ltd., a joint company owned by Petrochemicals, Ltd., and Lewis Berger & Co., Ltd.

After the polymerization processes, the residual liquids are sold as narrow-boiling-range aromatic solvents, containing practically no unsaturated material.

Naphthalene.—The crude naphthalene cut from the primary distillation is taken to crystallizers and the solid product is centrifugally separated to yield a "whizzed" naphthalene which is only just offwhite in color. Refined naphthalene is manufactured when required by subsequent chemical treatment and redistillation. The mother liquor from this separation is a pale, transparent, greenish-yellow liquid and is very different from the analogous coal-tar product. In fact, from all these fractions, including those higher than naphthalene, good colored solvents can be obtained. One particular solvent, because of its high thermal stability, is being used as a vapor-phase condensation heat transfer medium for temperatures up to 315° C. (599° F.).

Product purity.—The difficulties experienced in the separation of pure chemicals from coal tar, and the associated plant corrosion problems, are practically nonexistent with Catarole products, as oxygen and nitrogen compounds are absent in the charging stock. Sulfur, the only nonhydrocarbon contaminant in the charging stock, is present to the extent of only 0.1 per cent and of this quantity approximately two-thirds is converted to H_2S and removed in the gas-purification plant. The remainder is divided among the liquid products, and it is therefore obvious that very pure aromatics can be made easily from the Catarole products.

Although monostyrene is not yet being made from the ethylene and benzene produced at Petrochemicals, Ltd., a styrene polymerization and molding powder plant based on imported monomer has been built for Styrene Products, Ltd., a joint company of Petrochemicals, Ltd., and Erinoid, Ltd. This plant is now in full operation and has a capacity of 6,000 tons per year.[7]

Utilities. — Apart from the many process units there is a complex and complete services system, including a very modern steam and electrical generation plant, designed not only to deal with the present load, but to be capable of economical extention to cover future developments. This services system has absorbed quite a large proportion of the total capital expended,[8,9] but it is vital for the safe and profitable operation of the process plants of such an undertaking that continuous and adequate services are provided.

The history of the whole Petrochemicals' project, starting with the development from a new idea and culminating in the construction on a previously undeveloped site, provides an interesting and absorbing story, only the first chapters of which have as yet been written. It is confidently expected that future development of this chemicals-from-petroleum plant will continue over the next few years at a rapid rate.

References

1. British Patent No. 450,372.
2. N. Swindin, Transactions Institution of Chemical Engineers (London), 1949, 27.
3. British Patents 569405 and 569416 (Woodall Duckham).
4. H. E. Charlton, Transactions of Manchester Association of Engineers, 1949-50, p. 249.
5. E. Bonwitt and H. E. Charlton, Journal of Institution of Fuel, Vol. 23, No. 132, p. 183-197, July 1950.
6. H. E. Charlton, paper read before the Institution of Chemical Engineers, April 28, 1951, "Chemical Engineering as Applied to the Building of a Petroleum Chemicals Plant."
7. The Petroleum Times, Vol. LV No. 1404, p. 471, June 1, 1951.
8. W. E. Huggett, The Petroleum Times, Vol. LV No. 1403, p. 382, May 18, 1951.
9. A. J. Lowe and F. Chapman, Manufacturing Chemist, Vol. 22, No. 3, p. 103, March 1951.

Acknowledgment

With acknowledgment to the Institution of Chemical Engineers for permission to reproduce Figs. 1 and 3.

Creole Operates Two Multifunction Plants

(Continued from page 205)

and are processed for gasoline recovery. The flashed, and partially dewatered, crude from the surge drum passes through a series of heat exchangers to the crude stripper which operates at a pressure of 20 psi. Live steam is injected into the stripper feed and external heat is added to the stripper tower through a bottoms reboiler circuit to effect complete overhead removal of butane and lighter fractions.

Dehydration chemicals are injected into the stripped crude bottoms which are then pumped through additional heat exchangers to the crude-dewatering drum where crude emulsion is broken and settling of salt water takes place. This salt water is currently being used as a water-flooding agent in Jusepin field. The dewatered crude, containing approximately 0.5 per cent b.s. and w., then exchanges heat with incoming crude, is cooled, and is ready for fiscalization storage. A portion of the cooled stripped and dehydrated crude is withdrawn for use as an absorption menstruum.

Separator wet gas entering the plant passes first through a knockout drum and then to compressors. After two stages of compression and intercooling, part of the stream is fed to the absorber and the absorber dry gas, together with wet gas which bypasses the absorber, goes to the third stage of compression following which it is delivered, without aftercooling, to the gas-injection system feeding field pressure - maintenance input wells.

Rich oil from the absorber joins the raw crude feed to the crude-stripping tower. The vapors from the crude stripper are cooled and partially condensed, the condensate being pumped as liquid feed to the stabilizer while the uncondensed vapors are compressed in the process compressor. The process compressor operates in two stages; vapor from the first-stage discharge are cooled and partially condensed, the liquid being pumped to the stabilizer as liquid feed, while the uncondensed vapors are compressed in the second stage and enter the stabilizer as vapor feed. The gasoline stabilizer, which operates at 375 psi., is controlled for

removal of propane and lighter fractions in the overhead which is used as plant fuel. Butane and heavier hydrocarbons leaving the stabilizer as bottoms products are cooled whereupon they join the stripped and dehydrated crude stream, leaving the plant as a blend of stabilized crude-gasoline plant product.

Mulata. — The schematic diagram pertaining to the Mulata plant gives a general idea of the process flow as well as a comparison of stock-tank oil volumes and gravities with versus without the plant. Particularly significant is the increase of about 3° A.P.I. gravity in Mulata-crude gravity contributed by the plant.

Raw crude from the field separators is pressured to the plant where it enters a surge drum, on which is maintained a back pressure of 75 psi. The gas released from this drum is further processed for recovery of its butane and heavier hydrocarbon content. The crude leaving the surge drum is pumped through a series of exchangers where it acquires heat from outgoing dehydrated crude. The preheated crude is fed to a stripping tower where it is stripped of light ends by 200-psi. live steam and external heat to produce a propane-free, low-vapor-pressure bottoms.

"Stripped crude" bottoms are then pumped to the electrical dehydration section. The light ends taken overhead from the stripping tower contain large quantities of desirable butanes and heavier fractions; therefore the overhead is further processed for recovery of these fractions along with similar fractions extracted from the wet gas. The stripped crude leaving the stripping tower are pumped to the dehydration sphere where the crude is dehydrated electrically by the Petreco process in a "dehydration cycle" (no fresh water added).

In this process, "stripped" crude containing about 3.0 to 5.0 per cent b.s. and w. enters a 28-ft.-diameter sphere which is maintained at about 75 psi., which pressure is adequate to suppress vaporization. The crude containing emulsion passes up through electrodes where the water is coagulated and drops to the bottom of the sphere. A high water level is maintained in the sphere to insure oil-free water being withdrawn from the bottom to the sewer. The dehydrated oil is withdrawn from the top of the sphere whereupon it successively exchanges heat with incoming raw crude, is blended with stabilizer bottoms, cooled, and delivered to floating-roof fiscalization storage tanks.

The plant is designed for handling approximately 30,000,000 cu. ft. daily of 125-psi. wet gas and 30,700,000 cu. ft. daily of 25-psi. wet gas. Approximately 9,000,000 cu. ft. of the 25-psi. gas is compressed in one 800-hp. gas-driven compressor to 125 psi., and fed, together with the incoming 125-psi. wet gas, to the low-pressure absorber. The remainder of the 25-psi. wet gas is compressed in two stages to about 500 psi. whereupon it is fed to the high-pressure absorber.

Absorber wet-gas feed is contacted countercurrently with lean oil for extraction of butanes and heavier components, the enriched oil being accumulated for feed to the lean-oil still. The reabsorber processes stripper overhead uncondensed vapors, crude surge-drum gas, and recycle fractions from the lean-oil still overhead.

The enriched oil from all absorbers is fed to the lean-oil still which operates at about 100 psi. Lean-oil-volatility characteristics are controlled by lean-oil-still operation in conjunction with a lean-oil reclaimer. Approximately 20 bbl. per day of lean-oil makeup is supplied from stripped crude which is "topped" in the lean-oil reclaimer. Condensed liquid from the lean-oil still and crude stripper overhead are fed to the gasoline stabilizer which operates at 250 psi., where propane and lighter fractions are removed as overhead.

The bottoms from the stabilizer, namely butane and heavier gasoline, are successively cooled and blended with the stripped and dehydrated crude stream, the combined stream leaving the plant as a blend of stabilized crude-gasoline plant product.

Seven 800-b.hp. double-acting, gas-driven compressors provide for compression of 20,000,000 cu. ft. daily of gas from 25 to 2,200 psi. for injection into 16 input wells. Gas from the second stage of compression, after cooling, is processed through the high-pressure absorber. The dry gas leaving the absorber passes to the third stage of compression following which it leaves the plant at 2,200 psi. and about 250° F. through the injection system to the individual input wells. Dry gas from the low-pressure absorber is used as plant fuel and for driving gas turbines which, in turn, drive absorption-oil pumps.

Personnel

The Jusepin and Mulata plants are staffed with a total of approximately 80 employes. At the start of operations, shift operator and other key posts were filled by experienced gasoline-plant personnel recruited from the United States. As a result of an intensive and highly successful training program, which was begun early in the life of these plants, Venezuelan trainees have become qualified to fill these positions.* Consequently, only seven of the United States experienced personnel are still retained while the remaining placements are filled by Venezuelans who were trained on the ground during the operating life of these plants.

*An article pertaining to this training program entitled "Training Venezuelan Personnel in Gasoline-Plant Operation" was published in the December 1949 issue of The Mines Magazine.

Expansion in Burma Finally Under Way

(Continued from page 207)

in use throughout the postwar period.

The most vigorous efforts were made to rehabilitate the oil fields. A survey was first carried out to assess the extent of damage to the wells and the amount of oil, water, and junk in them. The proper tools and equipment were not all available when the work began but later six drilling outfits were set up, four of them being new Cardwell units. The first wells to be restored were those which were most productive before the war. Drilling tools, great lengths of steel tubing, ingots, pieces of iron, and all kinds of junk which had been dropped into them to make production impossible were salvaged, and many ingenious devices were invented by company engineers to assist the fishing operations.

The blow to the industry-wide program of recovery fell in mid-1948 when, a few months after Burma had gained her independence, political dissidents launched an armed rebellion against the government. Spreading quickly, the insurrection made it unsafe to continue repair work on the pipe line, and with this link between the oil fields and Syriam cut, plans for the new coastal refinery were jeopardized. Chauk oil field, now rehabilitated, contrived to operate, even during a period of rebel occupation, though on a much restricted scale, but at the older field of Yenangyaung, 40 miles south, rebel attacks and disturbances forced Burmah Oil to withdraw.

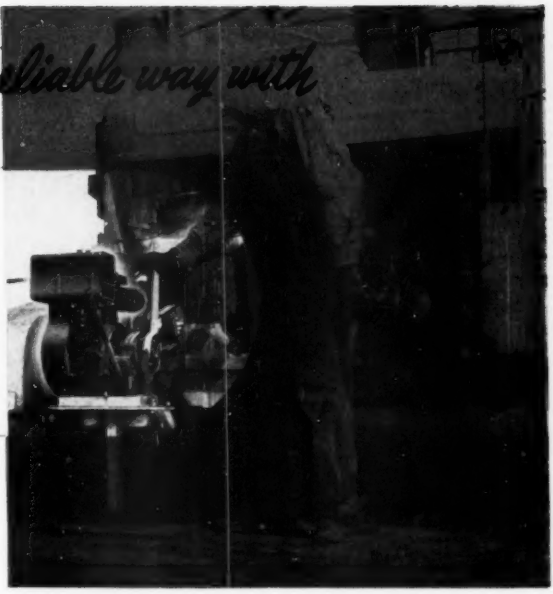
In such conditions of insecurity Burmah Oil had to make a change in its plans, the chief effect of which was to concentrate all producing and refining operations in the main Chauk field. By this means the company in 1949 and 1950 kept up with the times, bearing in mind the problems affecting the economical distribution of products, and by its current expansion of refining facilities Burmah Oil is perhaps even a little ahead of the times. For although the domestic situation has taken a slight turn for the better, the prospects for increased operations are still far from bright; the pipe line remains inaccessible, and without it there is no case for rebuilding the Syriam refinery. These matters await the full restoration of law and order throughout the country.

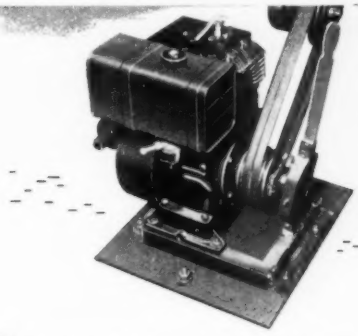
Chauk, the center of the Burma oil industry today, was brought in by Burmah Oil in 1902. More than 900 wells have been drilled, some down to nearly 5,000 ft., and as many as 12 to 15 oil sands have been found in different parts of the field.

Here a rotary drilling string is being employed to find new production and for the deepening of some prewar wells. For this work a National

Start engines the reliable way with

UNITED *Multi-Cylinder* ENGINE STARTER





Prices on Application.
(Most popular size $292.00)

- RELIABLE — Continuous cranking power from easily started gasoline engine.
- ECONOMICAL — Pays for itself by eliminating troublesome battery, generator and starter maintenance.
- SAFE — Recommended by safety engineers.
- EASILY INSTALLED — Simply remove electric starting motor and insert Heavy Duty Bendix Starter Drive Assembly. (Bendix Drive operates off of ring gear. Specify type of engine to be started when ordering.)

At Your Nearest United Supply Store

ELIMINATES BATTERY

ELIMINATES ELECTRIC STARTER

ELIMINATES GENERATOR

Courtesy
Service
Dependability

UNITED SUPPLY AND *Manufacturing* COMPANY

TULSA, OKLAHOMA

Stores in Kansas, Oklahoma, Texas,
Louisiana, and New Mexico

50 outfit will be used, and the company's rig-building department has designed a transporter to carry the draw works and other facilities from well to well in the field. Each of these components has its own skid, and the whole outfit is unitized on a third skid slung from the transporter. A jacking system incorporated in horizontal braces along top of the transporter can pick up the complete 16-ton unit for towing away to the next location.

For the refinery extension, Burmah Oil engineers are erecting a two-stage Winkler-Koch plant near one of the main roads through Chauk field. This plant, the atmospheric and vacuum towers of which are now in position, embraces a laboratory, wax-sweating and pressing equipment, bauxite-treating plant, tankage, and facilities for the ethyl blending of locally produced motor fuel.

Ethyl blending is now being carried out. The remaining plant is expected to be ready for operation by the end of 1952.

Shell's European Operations

(Continued from page 319)

tion is desalted and unreacted hydrocarbons are extracted before the final product is reached.

The next step in this field was in 1949 with the completion of the chemical plant at Stanlow. This chemical plant, starting from a gas-oil feed stock, produces a variety of solvents in a high state of purity.

The gas oil is fed to a thermal cracking unit operating at high temperature and low pressure for the maximum production of gaseous products. The butane - butylene and propane-propylene streams recovered from the cracked gases are the intermediate feed stocks for the manufacture of the chemical solvents.

The solvents produced include isopropyl alcohol, isopropyl ether, acetone, diacetone alcohol, methyl isobutyl ketone, secondary butyl alcohol, and methyl ethyl ketone.

At Rotterdam - Pernis there is a unit for the production of polyvinyl chloride. Dichlorethylene produced by the chlorination of ethylene is converted into vinyl chloride which on polymerization yields polyvinyl chloride.

To meet the increasing demands for chemical solvents, a new plant is under construction at Berre in France for the production of isopropyl alcohol, acetone, diacetone alcohol, and methyl isobutyl ketone.

Quite apart from the above which is based on petroleum, the group owns the N.V. Maatschappij tot Exploitatie van Kooksovengassen (Mekog) at Ijmiden in the Netherlands. This factory has an annual production capacity of 60,000 tons of ammonium sulfate; 110,000 tons of nitrate of lime, and 185,000 tons of lime ammonium nitrate.

Conclusion

This article has dealt exclusively with the development of the group's refining activities in Europe, which has, however, formed only a part of its world-wide program of refinery expansion. The continuous increase in demand during the period covered by this article has also necessitated a similar growth in the group's tanker fleet, berthing facilities, storage capacity, etc.

The result of these years of activity has been that the Royal Dutch-Shell Group is now firmly established as one of the largest European crude-oil refiners and an important operator in the petrochemical field in Europe.

England's Manchester Plant Undergoing Expansion

(Continued from page 320)

The wartime demand for sodium sulfonates gave rise to the installation of a continuous plant running in line with the continuous acid-treating plant. The result was a quick and standardized production of sulfonates and efficient alcohol recovery. A great deal of development work has been done on the extraction of water-soluble sulfonates from acid sludge, leading to the production of standardized products in both liquid and solid form. The demand for these materials as wetting agents and detergents continues to grow rapidly.

To reach the high standard demanded by the British Pharmacopoeia for liquid paraffin, a finishing process using silica gel contact has been developed and installed.

One interesting activity, rather outside the normal scope of the refinery, was the undertaking, on behalf of the British Supply Services, of the treatment of flame-thrower jelly. The disposal of this material constituted a real problem but methods were developed in the research laboratory, a plant installed and the balance of stocks for disposal in the country has now been worked off successfully. All the components were reduced to their original form and have gone back into industry.

Blending

In the process of installation is a new automatic continuous blending plant. This will replace to a major extent the conventional batch units which are now in operation, and the new plant is not only capable of proportioning the oil components, but also additives which are a major factor in demand today.

Research

Two large research establishments are maintained, one department dealing with all chemical problems and developments, and the other dealing with physics. All the developments which have taken place so far have been born in these two departments, and have led on the chemical side to the full use of aromatic extracts as chemical products in industry. While at first this particular development rested on the short supply of linseed and kindred oils, today the demand has been maintained by their own special characteristics and advantages. The chemical department has also been responsible not only for the industrial development and manufacture of petroleum sulfonates, but also for fundamental data on these products which was substantially original. Among other fields in which the department has done most important work is the development of the segregation and use of water-soluble sulfonates, the examination and method of separation of flame-thrower jelly, and a number of other processes in course of development, details of which will be published at a later date.

The physics department has contributed fundamentally to our knowledge of the spectrographic methods of analysis. It has developed, among many others, a criterion for the evaluation of liquid paraffin by ultra-violet spectroscopy, and it has developed a magnetic crack detector compound which has led to a large extension of the nondestructive examination of metal pieces.

BOOKS

OIL AND PETROLEUM YEARBOOK. Compiled and published by Walter E. Skinner, 20, Copthall Avenue, London, E.C.2, England. $4.

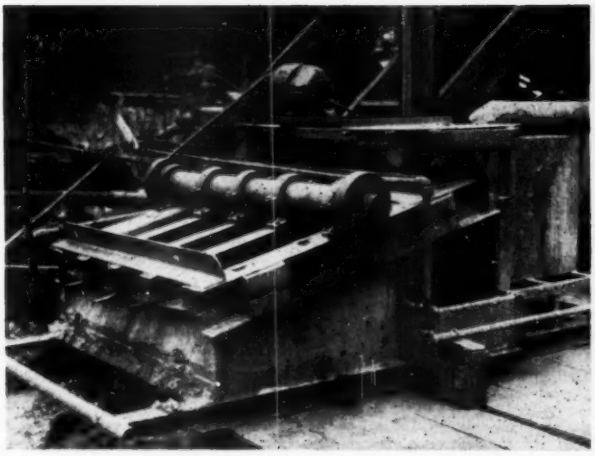
The 1951 edition of this standard reference work gives up-to-date particulars concerning 762 companies operating in all parts of the world and covering all branches of the oil industry, together with a list of names and addresses of 492 managers and engineers and the companies in the book with which they are connected. American and foreign companies are fully dealt with. The particulars of each company comprise names of directors and other officials, description of business, where operating, crude-oil production, refinery runs, details of capital, dividends, and financial results. The Buyers' Guide of Manufacturers of oil-field and refinery equipment comprises 705 headings.

HANDBOOK OF DANGEROUS MATERIALS. By N. Irving Sax. Published by Reinhold Publishing Corp., 330 West Forty-Second Street, New York. 848 pp. $15.

This reference book covers over 5,000 hazardous industrial materials, and offers valuable information to those concerned with safely handling, storing, or shipping chemicals and other dangerous materials. These materials are cross-referenced and indexed. Information about each material includes: maximum allowable concentration, toxicity, flammability, storage and handling, physical properties, formulas, and shipping regulations. Wherever possible, detailed information is given on symptoms, treatment and antidotes, first-aid suggestions, personnel safety precautions, fire-extinguishing agents, and other pertinent data. In addition, the complete text of the Interstate Commerce Commission Shipping Regulations is included for detailed instructions on labeling, packaging, storage, shipping, and all relevant subjects.

Screen Cloths last more than a year.

ITS RUMBA ACTION
REMOVES SAND AND SHALE BY NEW FLOTATION PROCESS



"RUMBA" Shale Shakers excel in performance and low cost maintenance. They come to you completely unitized on 10 ft. skids . . . no rigging up costs in the field. The underslung screen cloth, with no obstructions on the bottom, removes sand by floating it out on the bottom of the cloth. This design contributes to the longer screen cloth life . . . one of the features that is causing the worldwide demand for "RUMBA" Shakers.

HUTCHISON MANUFACTURING CO.
6609 AVENUE U • HOUSTON 11, TEXAS

GEOLOGRAPH

Yes sir — the job is done better and faster when all 3 tours are properly informed. That's why good drillers appreciate the completeness of the Geolograph record. This information encourages the kind of teamwork which makes the most hole *at the least cost per foot!*

GEOLOGRAPH
MECHANICAL WELL LOGGING SERVICE
P.O. Box 1291 - Oklahoma City 1, Okla.

ABILENE, HOUSTON, ODESSA, LUBBOCK & WICHITA FALLS, TEXAS
BAKERSFIELD, CALIF. — SHREVEPORT & BATON ROUGE, LA.
CASPER, WYOMING — OKLAHOMA CITY, OKLA.

A Better Strainer! —by DAVIS

— with BOLTED CAP

Bolted cap construction is used in sizes from ½" to 12".

If you think all strainers are alike, ASK THE MAN WHO HAS TO GET INTO THEM! Davis builds strainers with bolted caps (instead of threaded caps) because numerous engineers have asked for them. It's easier to remove bolts than to try to unscrew a large thread cap after a strainer has been in use. Also makes possible locating blow-off at lowest point; no sediment pocket. Don't confuse Davis precision-made strainers with ordinary pipe fittings. Available in wide choice of types for steam, air, gas, or fluids. Semi-steel, bronze, or steel bodies; screwed or flanged. Pressures to 1500 p.s.i. Brass, stainless or monel trim. Ask for bulletin 100-A.

DAVIS REGULATOR COMPANY
2543 South Washtenaw Ave., Chicago, Ill.

Nearly Half Million Producing Wells Strain to Meet Mounting World Needs

by William P. Sterne

NEARLY half a million oil wells throughout the world are producing more than 11,750,000 bbl. of petroleum daily—an all-time record.

But in spite of this record output, the world's needs for petroleum and its related products are ever increasing, and most countries are striving to stay abreast of these demands by pushing their exploratory and development programs to the limit.

During September, daily average crude-oil production throughout the world was 11,757,400 bbl., representing a gain of approximately 683,100 bbl. daily over the same period a year ago. This phenomenal growth in petroleum production is the result of widespread activity in the industry aimed at meeting the rapidly increasing consumption, and adding to future reserves.

Of the 468,077 producing well, exclusive of Russia and its satellites, reported in The Oil and Gas Journal's survey, 461,605 are in the Western Hemisphere, 3,492 in Europe and Africa, 403 in the Middle East, and 2,577 in Asiatic areas.

Accumulated production as of July 1, 1951, amounted to 66,649,466,100 bbl., including Russia and its satellites' estimated output of 8,448,450,000 bbl.

Drilling wells.—The Journal's 1951 survey revealed that, exclusive of Russia and its dominated countries, there were 5,748 wells drilling. Of this total, 5,626 were drilling in the Western Hemisphere, with the United States far in the lead with 5,329. Europe and Africa accounted for 70 drilling wells, the Middle East 18, and Asia, 34.

The United States held the world-production lead during the year, although its percentage of world supply continued to decrease. In September, a daily average of 6,284,000 bbl. was produced, exceeding the rest of entire world areas remaining.

Crude-oil reserves have been added to substantially due to the increased drilling program. Estimated world total, including the assumed 8,062,000,000 bbl. reserves of Russia and its dominated countries, was 102,320,850,000 bbl. as of July 1.

Summary of World's Oil Fields

Country—	No. of producing wells	Accumulated production 7-1-51 (thou. of bbl.)	No. of wells drilling
Western Hemisphere:			
Argentina	*1,286	*174,116.6	*5
Bolivia	32	5,805.1	4
Brazil	126	1,259.6	7
Canada	2,306	212,502.4	96
Chile	9	1,058.0	2
Colombia	1,444	520,940.9	11
Cuba			
Ecuador	921	52,094.2	9
Mexico	1,177	2,545,787.0	48
Peru	3,220	334,510.7	30
Trinidad	2,188	219,857.3	12
United States	†441,242	42,088,919.0	†5,329
Venezuela	7,654	5,766,526.8	73
Total	461,605	51,923,377.6	5,626
Europe and Africa:			
Algeria	12	54.8	1
Egypt	123	160,534.2	3
France	609	20,175.8	18
French Morocco	59	1,114.3	3
Germany	2,107	94,136.5	45
Italy	228	1,522.3	
Netherlands	121	17,143.3	
United Kingdom	233	4,951.0	
Total	3,492	299,632.2	70

Country—	No. of producing wells	Accumulated production 7-1-51 (thou. of bbl.)	No. of wells drilling
Middle East:			
Bahrein	72	126,366.8	1
Iran	81	2,528,000.0	7
Iraq	31	497,353.0	4
Kuwait	92	365,056.5	2
Qatar	14	21,846.0	
Saudi Arabia	109	840,102.9	4
Turkey	4	60.0	
Total	403	4,378,785.2	18
Other Asia:			
Burma‡		83,000.0	
China			
India‡	562	46,000.0	6
Indonesia-Br. Borneo	1,995	1,464,915.1	26
Japan		7.7	
New Guinea	14	4,513.3	1
Pakistan	6	785.0	1
Total	2,577	1,599,221.1	34
Total world excl. U.S.S.R. and satellites	468,077	58,201,016.1	5,748
Total U.S.S.R. and satellites‡		8,448,450.0	
Grand total		66,649,466.1	

*Excluding operations of government (Y.P.F.). †Estimate at beginning of 1951. ‡Estimated.

Journal's International

SURVEY OF OIL FIELDS

Alaska

OPERATIONS are confined to 35,000-sq. mile U. S. Naval Petroleum Reserve No. 4 in Arctic area where exploration work started in 1944. One test has been completed as gas well near Point Barrow in 1948 and gas has been made available at operating camp there. Additional exploration activities are scheduled for 1952. Arctic Contractors, with headquarters at Fairbanks, are in charge of operations under direction of the Navy.

ALASKA

Name of field—	Year of discovery	Number of wells: Flowing	Pumping	Shut in	Drilling	Production in bbl.: Daily average	Accumulated to July 1, 1951	Gravity °A.P.I.	Producing depth (ft.)	Name and type of formation
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
South Barrow*	1948			1					2,343-2,504	Jurassic
Umiat	1950			4	4				304-966	Cretaceous
Total Alaska				†5	4					

*Core-hole tests in Simpson area have small potential of low-gravity crude-oil production at depths ranging from 289 to 355 ft. Wells not included in world total. †Includes gas well.

Albania

No reliable information is available currently on petroleum operations in this Russian satellite country. Latest known producing areas in Albania are Deovli, Berat, and Skodra Lake fields.

Algeria

PRINCIPAL operating company is Soc. Nationale de Recherches et d'Exploitation de Petrole en Algerie, in which both France and Algeria are interested. Head office is 34, Boulevard Saint-Saens, Alger, and its Paris office is 42, Rue La Boetie, Paris (Se).

ALGERIA

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Oved Gueterini	1949	3	9		1	200	54,815	23	984	Eocene

Argentina

THE government oil agency, Yacimientos Petroliferos Fiscales, the leading operator in Argentina, releases no official information on production or exploration activity. Address is Avenida Presidente Roque Saenz Pena 777, Buenos Aires. (New York office, 80 Broad Street). Other major operators include: Standard Oil Co., S. A., Argentina (Jersey Standard), Avenida Presidente Roque Saenz Pena 567, Buenos Aires; Cia de Petroleo, Edificio Shell- Mex, Avenida Presidente Roque Saenz Pena 788, Buenos Aires (Royal Dutch-Shell Group); Cia. Astra de Petroleo, Avenida Alem 621 (R. I.), Buenos Aires.

ARGENTINA

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Agua Blanco[1]	1926		3	4		56	1,345,105	22.5	2,300-3,600	Permian sand
Astra[2]	1915		255		3	3,500	27,900,000	25	2,000-4,500	Cretaceous sand
Comodoro Rivadavia-K27[3]	1925	1	433		1	9,860	73,100,000	24	3,400	Cretaceous sand
Cerro Tartagal[1]	1926		1	3		24	124,255	45	2,300-3,600	Permian sand
Dadin[1]	1924		34	19		246	8,271,352	33.5	1,640-3,300	Jurassic sand
Huincal[1]	1923	6	40	15		291	4,180,928	33.1	2,600	Jurassic sand
Jose Secundo[4]	1922		13			44	737,087	16	2,307-3,576	Cretaceous sand
Kilometro 8[4]	1915		227		1	680	26,376,084	19	1,677-1,713	Cretaceous sand
Lomitas[1]	1927		23	24		157	3,548,498	42.6	700-3,300	Permian sand
Mananital Rosales[4]	1922		115			548	8,297,415	18	1,975-3,025	Cretaceous sand
Ramos[1]	1928		2	1			83,251	53.6	3,770-3,930	Devonian sand
Reserva[4]	1922		2			9	146,210	16	1,750	Cretaceous sand
San Pedro[1]	1928		22	18		851	15,311,814	30-44	1,800-3,300	Permian sand
Sindicato[4]	1928		37			135	1,245,548	16	2,965	Cretaceous sand
Solano[4]	1920		72			214	3,449,074	18-20	1,540-2,690	Cretaceous sand
Total Argentina		7	1,279	84	5	[5]16,615	[5]174,116,621			

(1) Esso Productora (Standard Oil Co. of N. J.). (2) "Astra" Cia. Argentina de Petroleo, S.A. (3) Diadema Argentina S.A. de Petroleo. (4) Ferrocarrilera de Petroleo. (5) Excluding Y.P.F.

Austria

RUSSIA continues control over Austrian oil production. Non-Russian companies are represented by R. K. Van Sickle Co. and Rohoelgewinnungs, A.G. Van Sickle interests are handled by a trustee in Vienna. Socony-Vacuum Oil Co., Inc., and Shell share ownership of Rohoelgewinnungs (Rag) with Socony-Vacuum in charge of management. Rag's Austrian address is Schwarzenbergplatz 5, Vienna 1 (New York address, 26 Broadway). The Soviet Mineral Oil Administration is located at Kantgasse 1, Vienna, 1.

Bahrein Island

THE operating company is Bahrein Petroleum Co., Ltd. (Standard Oil Co. of California and The Texas Co.). Main offices, 551 Fifth Avenue, New York, 17. Field headquarters are addressed at Bahrein Island, Persian Gulf.

BAHREIN ISLAND

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Bahrein	1932	72			1	30,000	126,366,770	33.5	2,000-2,500	Cretaceous lime

Bolivia

OPERATIONS are controlled by Yacimientos Petroliferos Fiscales Bolivanos, Apartado Corro 401, Avenida Gral. Camacho (Esquina Bueno), La Paz. U. S. representative, G. Rovira, is located at 707 Tower Building, Washington, D. C.

BOLIVIA

Name of field—	Year of discovery	Number of wells: Flowing	Pumping	Shut in	Drilling	Production in bbl.: Daily average	Accumulated to July 1, 1951	Gravity °A.P.I.	Producing depth (ft.)	Name and type of formation
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Bermejo	1924	1	4			245	989,039	26	2,000	Permo-Triassic
Camiri	1927	15	3		4	1,084	3,024,059	53	2,500	Devonian
Sanadita	1926		9			134	1,792,040	42	2,100	Permo-Triassic
Total Bolivia		16	16		4	1,463	5,805,138			

Brazil

CONSELHO NACIONAL DO PETROLEO, the Brazilian Government agency, carries out oil development in the country. Address is Avenida Presidente Wilson, 164-90 Andar, Rio de Janerio.

BRAZIL

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Aratu	1942		3			25	57,222	44	1,550	Cretaceous
Candeias	1941	19	43		3	3,877	1,039,837	26-30	2,500-4,000	Cretaceous
Catu	1950	1			1	300		40.5	4,145	Cretaceous
Dom Joao	1947		38		1	2,014	23,688	37	700	Cretaceous
Itaparica	1942		16			400	64,628	35	1,800-2,500	Cretaceous
Lobato-Joanes	1939		4			40	72,136	36	2,000	Cretaceous
Paramirim	1950	1			1	500	2,145	33.7	3,714	Cretaceous sand
Pedras	1950	1			1	300			575	Cretaceous sand
Total Brazil		22	104		7	7,456	1,259,656			

Burma

PRINCIPAL operator in Burma is Burmah Oil Co., Ltd., Britannic House, Finsbury Circus, London, E.C. 2. Other companies include: British Burmah Petroleum Co., Ltd., Bilbao House, 36, New Broad Street, London, E.C. 2. and Indo-Burma Petroleum Co., Ltd., 24-28 Lombard Street, London, E.C.3.

BURMA

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Chauk	1902					[1]1,400	83,000,000	36	2,500-5,000	Oligocene sand

1. Estimate. Information on current status of oil operations in Burma not available.

Canada

AMONG the larger Canadian companies which have been domiciled in the dominion for some time, and which have refining and marketing operations in addition to production are: Imperial Oil, Ltd., (Standard of New Jersey), 56 Church Street, Toronto; British American Oil Co., Ltd., Bay and College streets, Toronto; McColl-Frontenac Oil Co., Ltd., (The Texas Co.), 360 St. James Street West, Montreal; Shell Oil Co. of Canada, Ltd., 25 Adelaide Street East, Toronto; Royalite Oil Co., Ltd., 606 Second Street West, Calgary, Alta.; and Canadian Oil Companies, Ltd., 204 Richmond Street West, Toronto.

CANADA

Name of field—	Year of discovery	Number of wells*: Flowing	Pumping	Shut in	Drilling	Production in bbl.†: Daily average	Accumulated to July 1, 1951	Gravity °A.P.I.	Producing depth (ft.)	Name and type of formation
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Acheson-Stony Plain:										
Lower Cretaceous	1950	2			}	44	14,250	36.5	3,941-4,250	Lower Cretaceous
Devonian	1950	17			} 5	998	225,872	37	4,950	Upper Devonian-D3 dolo.
Barons	1950		1		1	45	9,691	34	4,100	Bow Island (Creta.) sand
Barrhead	1949						4,917	22-24	3,970	Upper Mississippian dolo.
Big Valley:										
D2 zone	1950	5				170	10,092	36.6-34.2	5,240	Upper Devonian-D2 dolo.
D3 zone	1950	2				92	7,965	33-33.5	5,300	Upper Devonian-D3 dolo.
Bon Accord	1949	1				29	24,694	35	5,580	Upper Devonian-D2 dolo.
Brooks (Bantry)	1947	2				18	47,095	22	3,250	Lower Cretaceous sand
Bulwark	1950		1		1	14	5,282	34	3,060	Viking (Creta.) sd
Campbell	1949		8		3	215	103,729	31-35	3,700	Lower Cretaceous sand
Camrose	1951		2		3	38	6,950		3,200	Viking (Creta.) sd.
Conrad	1944		15			283	1,083,800	26	3,200	Ellis (Jurassic) sand
Del Bonita-Twin River	1943		3		1	69	78,243	31-34	5,060	Upper Mississippian lime
Dina	1929					21	81,459	13	1,800	Lower Cretaceous sand
Drumheller	1950				2	18	3,303	34	4,445	Lower Cretaceous sand
Duhamel	1950	6			2	286	51,703	34	4,700	Upper Devonian-D3 dolo.

CANADA (Continued)

Name of field	Year of discovery	Number of wells* Flowing	Pumping	Shut in	Drilling	Production in bbl.† Daily average	Accumulated to July 1, 1951	Gravity °A.P.I.	Producing depth (ft.)	Name and type of formation
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Ellerslie:										
Viking	1950				1	23	4,228	34.5		Viking (Creta.) sd.
Lower Cretaceous	1950		4			34	6,851	35	3,910	Lower Cretaceous sand
Excelsior	1949	28			1	1,565	557,144	31-37	3,820	Upper Devonian-D2 dolo., lime
Golden Spike	1949	8			2	1,124	581,433	34-38	5,365	Upper Devonian-D3 lime
Joseph Lake	1949		48		3	1,496	475,597	36	3,270	Viking (Creta.) sd.
Jumping Pound	1944	3			2	67	21,814	51-53	10,000	Upper Mississippian lime
Leduc:										
Lower Cretaceous	1948		17			517	499,305	37.5-39	4,200	Lower Cretaceous sand
D2 zone	1947		268			11,722	7,959,232	38-40	5,100	Upper Devonian-D2 dolo.
D3 zone	1947		354			2,028	22,534,491	38-40	5,300	Upper Devonian-D3 dolo.
Lloydminster:										
Alberta	1939		120		4	2,161	2,986,611	9-16	1,920	Lower Cretaceous
Saskatchewan	1939		118			3,204	3,967,808	9-16	1,920	Lower Cretaceous
Norman Wells	1920		12			905	3,373,810	39	1,050-1,900	Ft. Creek (Devonian) lime
Normandville	1949	1	1			44	42,316	39	6,730	Upper Devonian
Ontario	1859					525	30,969,787	26-39	500-3,000	Dev., Ord., Silur., dolo.
Petrolia	1877		51			20		32	470	
Pincher Creek	1948	1			1	74	18,036	39	11,755	Upper Mississippian lime
Princess	1944		11			217	749,835	20-35	3,300-3,985	Mississippian lime, Devonian dolo.
Redwater	1948		849		6	52,854	25,143,419	34-36	3,100	Upper Devonian-D3 lime
Spring Coulee	1950		3			28	9,767	36-39	6,000	Upper Mississippian lime
Stettler:										
Lower Cretaceous	1949		2			57	20,312		4,250	Lower Cretaceous
D2 zone	1949	20			5	1,083	335,060	24-31	5,200	Upper Devonian-D2
D3 zone	1949	9				420	189,766		5,330	Upper Devonian-D3 dolo.
Stony Creek	1910					41	666,158	37	1,000-3,200	Albert (Miss.) lime
Taber	1942		18			602	1,415,601	18-23	3,200	Lower Cretaceous
Turner Valley:										
Shallow zone	1913		3			13	517,665		3,100	Lower Cretaceous sd.
Limestone zone	1924	263			1	8,460	106,038,550	43	3,450-9,150	Upper Mississippian lime, dolo.
Vermillion	1939		22			90	1,244,734	15	1,850	Lower Cretaceous sand
Virden	1951		1		2			33	2,200	Upper Mississippian lime
Wainwright	1923		2			35	311,497	14-20	2,250	Lower Cretaceous sand
Whitelaw	1950				3	7	7,415	28	3,880	Triassic
Whitemud	1949	4				93	88,837	35-39	4,055	Lower Cretaceous sand
Others‡					4	12	6,300			
Total Canada		372	1,934		96	91,975	212,502,424			

*Includes only wells producing on July 1, 1951. †1 Bbl. = 35 imperial gallons. (1) Estimated. (2) Includes: Armena, Bolloque Lake, Chip Lake, Hanna, Morinville, Volmer, Wizard Lake.

Chile

CORPORACION DE FOMENTO, government organization, carries out all producing and exploratory work in Chile. Headquarters are in Santiago, with New York offices at 37 Wall Street.

CHILE

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Manantiales	1945	3		15		350	762,660	42	7,500	Springhill sand (Cretaceous)
Sombrero	1950	1				600	61,470	42	7,500	Springhill sand (Cretaceous)
Victoria Norte	1950	1			1	50	10,360	42	7,500	Springhill sand (Cretaceous)
Victoria Sur	1950	4			1	1,000	223,500	42	7,500	Springhill sand (Cretaceous)
Total Chile		9		15	2	2,000	1,057,990			

China

Reliable information on fields and production in China is not available, due to political disturbances. Estimates give Chinese production at 2,200 bbl. daily for August 1951.

Colombia

THE De Mares concession, formerly operated by Tropical Oil Co. (International Petroleum Co., Ltd.), reverted to the government in August. The concession is now operated by the government firm, Empresa Colombiana de Petroleos. A new company, International Petroleum Co. of Colombia, made an important oil discovery

Colombia (Continued)

75 miles north of the De Mares area with its Totumal wildcat in the middle of the Magdalena Valley. International Petroleum is a subsidiary of International Petroleum Co., Ltd., Coral Gables, Fla. Other major operators include: Cia. de Petroleo Shell de Colombia, Edificio Virrey Solis, Carrera 9, 11-45, Bogota; Colombian Petroleum Co. (Socony-Vacuum and The Texas Co.), which operates the Barco concession, Cucuta; Cia. del Valley del Magdalena (Socony), Edificio Virrey Solis, Carrera 9, 11-45, Bogota; and Texas Petroleum Co. of Colombia, Carrera 8, 12-59, Bogota.

COLOMBIA

Name of field	Year of discovery	Number of wells: Flowing	Pumping	Shut in	Drilling	Production in bbl.: Daily average	Accumulated to July 1, 1951	Gravity A.P.I.	Producing depth (ft.)	Name and type of formation
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Cantagallo	1942	3	2			1,100	1,668,257	21.3	5,400-6,500	Eocene
Casabe (Yondo)	1941	58	131		4	35,665	37,469,125	20.9	2,140-5,600	Oligocene
El Difícil	1943	13				1,972	3,768,712	42.1	5,500-5,843	Oligocene
Ortega	1951			1	1			29.2	5,293	Cretaceous
Tetuan	1949			3	1			23	2,700	Cretaceous lime
Velasques (Teran)	1946	7			1	1,400	973,498	26.4	7,100	Eocene
Barco Concession										
Carbonera	1939		2			45	182,493	19.6-21.5	3,359	Barco, Los Cuervos, Eocene
Petrolea	1933	24	3			1,300	31,364,318	35-46.6	130-1,500	Cretaceous
Rio de Oro	1937		9		1	100	92,842	30-40	1,400-1,800	Catatumba, Urio, Juan, Cretaceous
Sardinta-Norte	1950	1				425	10,615	55.6	9,390	Cretaceous
Tibu	1940	85	69		3	25,600	37,101,414	29-54	3,570-9,225	Barco, Catatumba, Cogollo, Urib., Eocene, Creta.
De Mares Concession*										
Colorado	1930	2	2			200	449,919	38	3,400-4,200	Eocene
Galan	1945		3			200	199,744	19.5	3,900-4,050	Oligocene
Infantas-La Cira	1918-1926	6	1,024			38,000	407,660,000	24.5	500-4,000	Oligocene-Eocene
Total Colombia		199	1,245	4	11	106,007	520,940,937			

*Reverted to Colombian Government, August 1951

Cuba

NATIONAL companies hold Cuba's relatively small production. Sporadic attempts have been made by subsidiaries of both American and British oil companies in the past 40 years to find new oil deposits, without favorable results.

CUBA

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Jarahueca	1943					190		37-45	1,500	
Montembo	1880					55		58-61	600-1,800	
Total Cuba						245				

Czechoslovakia

THE Czechoslovakian oil industry is now under the control of Russia. Producing and refining were placed under the state company Moravske Naftove Zavody, Narodni Podnik, Hodonin, which is supervised by the Central Direction of the Czechoslovakian Mining Industry.

Ecuador

TWO British companies account for the major production in Ecuador. Anglo-Ecuadorean Oilfields, Ltd., has field offices at Santa Elena, Ecuador, and its London offices are at 146, Dashwood House, Old Broad Street, London, E.C.2. Ecuador Oilfields, Ltd., has field offices at Guayaquil, P.O. Box 865, and London offices in River Plate House, Finsbury Circus, E.C.2.

ECUADOR

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Ancon	1913	49	743		7	5,420	43,048,530	38	500-5,500	Eocene
Carolina-Sta. Paula			31		1	120	1,243,800	27	500-1,300	Eocene
Cautivo-Tigre[1]	1920	60				1,200	5,832,000	38	400-6,000	Eocene
Concepcion	1931		19			260	1,013,724	37	300-5,000	Eocene
Petropolis	1937		19		1	230	956,178	30	1,400-4,000	Eocene
Total Ecuador		109	812		9	7,230	52,094,232			

1 Estimated

Egypt

PRINCIPAL operators in Egypt are Anglo-Egyptian Oilfields, Ltd. (Shell controlled), Shell House, Cairo; and Socony-Vacuum Oil Co., Inc., Sharia Ibrahim Pasha, Cairo. Standard Oil Co. of Egypt (Jersey Standard) has withdrawn from operations.

EGYPT

Name of field	Year of discovery	Number of wells: Flowing	Pumping	Shut in	Drilling	Production in bbl.: Daily average	Accumulated to July 1, 1951	Gravity A.P.I.	Producing depth (ft.)	Name and type of formation
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Asl	1948	7			1	12,536	7,838,297	22	2,870-3,870	Eocene lime
Gemsa	1908			1			1,442,098	41	400-2,000	Miocene lime
Hurghada	1913		23	5		908	37,615,721	22-30	700-2,500	Miocene, Cretaceous
Ras Gharib	1938	14	76	26	1	22,521	98,699,988	26	1,200-2,500	Miocene, Cretaceous
Ras Matama	1948			3				20	1,940-3,200	Miocene
Sudr	1948	8	1	6	1	11,580	14,938,093	19-23	2,000-3,100	Eocene lime
Total Egypt		29	94	41	3	47,545	160,534,197			

1 Estimated.

France

FRENCH companies which operate in that country include: Soc. Nationale des Petroles du Languedoc Mediterraneen, 39 bis, Rue de Chateaudun, Paris; head office, Villa Elisabeth, Chemin du Pioh de Boutonnet, Montpellier (Herault); Soc. de Pechelbronn, 4, Rue Leon Jost, Paris (17eme), and Merkwiller-Pechelbronn (Bas-Rhin); Soc. Nationale des Petroles d'Aquitaine, 11, Rue du Doctuer Lancereaux, Paris (8eme), and head office, 27, Due de la Republique, Saint Gaudens (Hte.Garonne).

FRANCE

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Lacq	1949	11			3	5,000	1,300,000	21	2,200	Cretaceous
Pechelbronn	1815-1933	4	592		15	1,200	18,825,900	32	1,300-3,000	Oligocene, Jurassic, Triassic
St. Marcet	1939	2			....	10	49,900	45	5,900-6,400	Jurassic, Cretaceous
Total France		17	592		18	6,210	20,175,800			

French Morocco

OIL operations in French Morocco are handled by Soc. Cherifienne des Petroles (S.C.P.), jointly owned by French and Moroccan governments. Offices are at 38, Rue de la Republique, Rabat (Maroc).

FRENCH MOROCCO

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Am Hamra	1918		15		....	34	74,249	38	400-450	Tortorian
Bou Draa	1936		1		....	1	164,378	37	1,500	Liasic lime
Mers El Kharez	1951	1			1	90	2,119	35	4,600	Primarie
Oued Beth	1947	29			2	595	597,233	35	2,900-4,600	Primarie
Sidi Fili	1950	12			....	770	133,504	36	4,600	Primarie
Tselfat	1934		1		....	11	142,810	40	1,800	Toarcian
Total Fr. Morocco		42	17		3	1,501	1,114,293			

1 Includes production by mining.

Germany

THE major oil companies operating in Germany are: Gewerkschaft Elwerath, Hanover; Deutche Erdoel, Hamburg; and Wintershall, Celle. Foreign companies are Brigitta (Standard Oil Co. [N.J.] and Shell), Steimbke; and Vacuum, Celle.

GERMANY

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Baden District										
Forst-Weiher	1934		49			56	572,143	32-34	1,200-2,600	U. Eocene, Keuper, Dogger ss.
Weingarten	1936		80		2	75	303,833	32-36	800-1,600	Tertiary, Oligocene
Emsland District										
Adorf	1946		1		....	15	41,706	30	4,000-4,400	Lower Cretaceous, shell beds
Emlichheim	1944	51	1		1	214	3,504,450	25	2,400-2,900	Lower Cretaceous
Georgsdorf	1944	93	9		3	102	3,915,492	24	1,600-3,300	Valendis, L. Cretaceous sand
Lingen-Dalum	1942	1	89		7	1,700	2,408,165	30-32	2,600-3,800	Lower Cretaceous
Ruehlermoor	1949	7	13		3	1,800	486,759	25	2,000-2,800	Valendis, L. Cretaceous sand
Ruehlertwist	1949		15		1	1,180	251,280	25	2,380-2,890	Valendis, L. Cretaceous sand
Scheerhorn	1949	7				300	125,459	30	3,600-3,700	Valendis, L. Cretaceous sand
Hamburg District										
Reitbrook	1937	65	63			401	8,533,417	20.6	1,443-2,624	Tertiary, Upper Cretaceous
Hanover District										
Broistedt	1937		10		....	105	287,719	33	2,400-3,200	Valendis, Lower Cretaceous
Calberlah	1945		8		1	15	28,524	19-22	160-400	Dogger, Jurassic sd.
Eddesse-Oelheim	1876		22			55	1,665,609	32	2,800-3,300	Rhaetic, Triassic sd.
Ehra	1939		13			9	74,146	17	500-820	Jurassic sand
Eicklingen-Wienhausen	1937		15			180	1,843,856	32-33	1,650-3,100	Valendis, Wealden, Cretaceous sand
Eilte	1947	1				2	8,629	24.7	3,560-3,700	Lower Cretaceous

GERMANY (Continued)

Name of field	Year of discovery	Number of wells: Flowing	Pumping	Shut in	Drilling	Production in bbl: Daily average	Accumulated to July 1, 1951	Gravity °A.P.I.	Producing depth (ft.)	Name and type of formation
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Eldingen	1949	11	1		3	850	175,352	34	4,900-5,300	Angulaten ss., Liassic
Etzel	1942		2		1	90	225,311	13	4,550-4,700	Caprock, Jurassic lime
Fuhrberg-Hambuehren	1939		225		4	1,100	3,607,493	24	260-2,100	Dogger ss., Jurassic
Gifhorn	1935		43			35	309,425	17	660-820	Wealden, Lower Cretaceous sand
Hademstorf	1935	9	4			167	507,964	26	3,970-4,480	Cretaceous, Jurassic
Hanigsen	1940	34				541	2,887,480	27.5	2,237-2,785	Lower Cretaceous
Hohne	1951	4			2	250	25,107	34	5,700-6,500	Liassic sand.
Hohenassel	1943		30		1	390	1,304,887	30	1,425-2,100	Coral oolite, Jurassic
Meckelfeld	1938		20			45	367,124	24	1,000-1,670	Cretaceous
Moelme	1935		29			84	1,031,497	32	160-1,800	Cretaceous, Coral oolite, Rhaetic
Nienhagen	1889		203		1	1,520	31,509,137	22-32	600-5,350	Cretaceous-Jurassic
Oberg	1919		58			195	2,360,667	37.1	525-1,900	Cretaceous-Jurassic
Quakenbrueck	1950	7	9		1	157	228,976	34.8	1,608-1,939	Cretaceous-Jurassic
Steimbke-Redewald	1936	54	237		2	1,742	4,319,282	16-19	790-3,700	Serpulite, Cornbrash ls., ss., Jurassic
Suderbruch	1949	17	3		2	1,964	787,524	25-37	3,800-6,792	Cretaceous-Jurassic
Thoren	1941	6	52		1	156	657,538	18-35	1,719-4,000	Cretaceous-Jurassic
Wathlingen	1950		4		1	150	25,526	27	2,000	Jurassic sand
Wesendorf	1943		51		4	1,607	2,846,455	17-41	1,250-6,000	Neocomian, L. Dogger, Liassic ss.
Wietze	1874		322			560	16,908,549	18-27	300-1,080	Senonian, Wealden, Cornbrash, Rhaetic, Cretaceous, Jurassic
Schleswig District										
Heide	1935	-	59		4	1,450		18-32	2,500-4,500	L. Cretaceous, basal Breccia, Zechstein limestone.
Total Germany		367	1,740		45	18,656	94,136,481			

Hungary

Reliable data on oil fields and their production are not currently available from official sources in Hungary.

India

OPERATING companies in India include Assam Oil Co., Ltd., subsidiary of Burmah Oil Co., Ltd., Digboi P.O., Lakhimpur District, Assam; and Burmah Oil Co. (India Concessions), Ltd., P.O. Box 2039, 7 Wellsley Place, Calcutta, India.

INDIA

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Digboi	1890	343	219		6	5,700	46,000,000	36	500-5,000	Miocene

Indonesia-British Borneo

COMPANIES operating in Indonesia and British Borneo include: Nederlandsche Pacific Petroleum Jim. (California-Texas Oil Co., Ltd.), headquartered in Batavia; Australasian Petroleum Co. (Anglo-Iranian Oil Co., Ltd., Standard-Vacuum Oil Co., [Standard Oil Co. (N.J.), Socony-Vacuum Oil Co.], and Oil Search, Ltd.) with field offices at Port Moresby and main offices at Melbourne; Nederlandsche Nieuw Guinee Petroleum Mij. (Shell, Standard-Vacuum, Standard Oil Co. of California, and The Texas Co.); Sarawak Oilfields, Ltd., Seria; British Malayan Petroleum Co., Ltd., a Shell subsidiary; N. V. Standard-Vacuum Petroleum Mij., with field offices at Soengi, Gerong, Sumatra, and N. V. de Bataafsche Petroleum Jim. (Shell), with field offices in Tjepu, Java; Balikpapan, Borneo; and Pladju, South Sumatra.

INDONESIA—BRITISH BORNEO

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Borneo										
Anggana-Muara	1902	3	93	22		2,960	63,804,900	19-33	380-3,200	Miocene
Balikpapan	1903			1			232,350	14.5		Miocene
Bunju[1]	1930			16	2		369,000	24-40	1,970-3,100	Pliocene
Sambodja	1910	1	49	1		1,250	54,199,400	19-33	160-4,400	Miocene
Sanga Sanga	1897	1	94	18	1	3,140	146,454,800	18-36	430-2,900	Miocene
Sangatta	1940			3	2		1,150	36	1,640-4,200	Miocene
Tandjung[2]	1938			20	1	210	559,400	40	2,500-4,300	Eocene
Tarakan	1906	3	484			6,900	165,286,000	20	195-2,400	Pliocene
Total Borneo		8	720	81	6	14,460	430,907,000			

(1) Niam field. (2) Field shutin, pipe line not yet available. (3) For operational use.

Brunei										
Seria	1929	85	[3]91	16	5	101,037	155,812,327	19-33	1,600-6,900	Tertiary sands
1. Inactive.										
Ceram										
Bula-Lemun[1]	1897						8,203,000	23	240-920	Triassic, Pliocene
1. Inactive.										
Java										
Kawengan	1926		44	6	1	11,200	43,964,300	34.5	1,750-2,700	Miocene
Kruka	1929		52	9		1,080	8,082,500	30.5	970-1,600	Miocene

JAVA (Continued)

Name of field	Year of discovery	Number of wells: Flowing	Pumping	Shut in	Drilling	Production in bbl.: Daily average	Accumulated to July 1, 1951	Gravity °A.P.I.	Producing depth (ft.)	Name and type of formation
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Ledok[1]	1896						21,125,000	43	320-3,200	Miocene
Lidah Kulen[1]	1896						33,369,000	24	490-1,330	Miocene
Loesi[1]	1932							40	2,300	Tertiary
Ngliron[1]	1940							40	6,000	Tertiary
Nglobo-Semanggi-Banjoeasin[1]	1897						18,044,000	43	370-3,550	Miocene
Petak[1]	1914							40	2,300	Tertiary
Tremboli[1]	1917							40	2,300	Tertiary
Total Java			96	15	1	12,280	124,584,800			

1. Inactive.

Sarawak

Miri	1911		122	16	1	1,013	[1]71,662,957	21-35	300-3,050	Tertiary

1. Includes estimate during Japanese occupation.

SUMATRA

(Northern District)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Dj Rajeu[1]	1929						559,000	54	2,520-2,590	Pliocene
Gebang[1]	1936						135,000	54	2,970-3,480	Miocene
P. Tabuhan[1]	1937						3,283,000	52	3,300-3,500	Miocene
Pangkalan Susu[1]	1917						6,287,000	56	1,550-2,100	Miocene
Pase	1939						[2]52,000	23-30	2,000	Tertiary
Perlak[1]	1900						47,870,000	57	160-2,200	Miocene
Pulu Pandjang[1,3]	1928						11,243,000	55	1,640-2,400	Miocene
Rantau[1]	1929						55,513,000	48	1,040-2,560	Miocene
Serang Djaja[1]	1926						7,551,000	64	3,560-4,150	Miocene
Telaga-Said-Darat-K. Gadjah[1]	1893						23,621,000	51	210-720	Miocene

(Central District)

Duri[4]	1940			6				22	475	Miocene
Lirik-Ukui	1941	2			2		[2]556,000	34	1,800	Tertiary
Minas[5]	1944			16	1			35	2,250	Miocene
Sebanga[4]	1940			3				30	1,200	Miocene

(Southern District)

Babat	1901	1	18			80	8,181,100	38	100-1,050	Miocene
Badjubang	1927	13	4	24		2,560	27,647,100	46	2,700-3,300	Miocene
Benakat	1933	134			1	9,500	[2]46,800,000	38	1,600	Tertiary
Betun	1950	6				2,500	[2]500,000	29	7,000	Tertiary sand
Betung[4]	1923						2,100,000	40	180-950	Miocene
Cunung Kamala	1938	2		2		1,140	930,500	34	6,070-6,250	Miocene
Djirak	1930	133				7,500	[2]28,200,000	38	1,000	Tertiary
Heruo Senami[4]	1938						95,700	48	2,400-2,650	Miocene
Kenali Asam	1931	44		11	1	13,300	26,914,900	22-46	1,700-4,100	Miocene
Karang Ringin[4]	1903						1,572,000	42	160-1,200	Pliocene, Miocene
Kluang[4]	1914						27,882,000	40	2,300-2,600	Miocene
Limau	1928	9			1	3,450	7,949,800	25	5,200-5,400	Miocene
Mangundjaja	1935	1	50	4		2,670	11,424,850	24	660-2,200	Pliocene
Moeara-Enim	1903		6			100	28,231,500	46	300-1,150	Pliocene, Miocene
Radja	1941	11			3	3,500	[2]2,100,000	40	7,000	Tertiary
Selo	1938							38	2,200	Tertiary
Suban Djerigi	1905		24			600	34,324,900	46	1,300-2,500	Pliocene, Miocene
Talang-Akar-Pendopa	1922	322			3	42,000	[2]161,902,000	38	2,800	Tertiary
Talang Djimar	1937	47		10	1	18,700	50,519,700	28	3,600-4,200	Miocene
Tandjoeng Tiga	1940	18			1	4,200	3,885,160	25	4,400-4,600	Miocene
Tempino	1931	28	1	2		5,580	41,841,800	48	1,930-2,700	Miocene
T. Luntar[4]	1912						4,072,000	56	2,200-2,800	Pliocene
Total Sumatra		770	103	78	14	148,320	673,745,010			
Total Indonesia-Br. Borneo		864	1,145	215	27	281,940	1,469,428,415			

(1) Inaccessible because of political disturbances. (2) To April 1, 1951. (3) Niam field. (4) Inactive. (5) Wartime discovery by Japanese.

NEW GUINEA

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Klamesin					1					
Klamono	1936	1	13	9		4,830	4,512,000	19	300	Miocene lime
Mogoi	1940				1		459	46	1,250	Miocene
Tembuni					1					
Wasian	1940				1		862	48	2,900-3,225	Miocene
Total New Guinea		1	13	9	4	4,830	4,513,321			

Iran

ANGLO-IRANIAN OIL CO., LTD., forced out of Iran this year, formerly had field headquarters at Abadan, Khuzistan, Iran. The Iranian oil industry is now under control of the government-sponsored National Iranian Oil Co., Abadan. Operations are now shut down.

IRAN

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Aga Jari	1937-1938	16			3	[1]312,000	426,000,000	35	6,000-9,000	Oligocene, Miocene
Gach Saran	1937	4				[1]49,000	130,000,000	33	4,000-7,000	Oligocene, Miocene
Haft Kel	1928	20				[1]158,000	999,000,000	39	3,000-4,000	Oligocene, Miocene
Lali	1946	4			1	[1]16,000	15,000,000	36	6,000-9,000	Oligocene, Miocene
Masjid-i-Sulaiman	1908	27				[1]52,000	872,000,000	37	2,000-3,000	Oligocene, Miocene
Naft-i-Shah, Naft Khaneh	1923-1926	3				[1]11,000	51,000,000	43.2	2,600-3,000	Oligocene, Miocene
Naft-Safid	1938	7			3	[1]20,000	35,000,000	35	5,000-6,000	Oligocene, Miocene
Total Iran		81			7	[1]618,000	2,528,000,000			

1. For January 1-June 30 period

Iraq

IRAQ PETROLEUM CO., LTD., is the major operator in Iraq. Its Midle East headquarters are in Tripoli, Lebanon, and London offices are at 214, Oxford Street, Oxford Circus, London, W.1. Anglo-Iranian Oil Co., Ltd.'s subsidiary, Khanaquin Oil Co., Ltd., operates Naft Khaneh field on the Iran-Iraq border.

IRAQ

Name of field	Year of discovery	Number of wells: Flowing	Pumping	Shut in	Drilling	Production in bbl.: Daily average	Accumulated to July 1, 1951	Gravity A.P.I.	Producing depth (ft.)	Name and type of formation
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Ain Zalah	1940			9	1			32.8	5,500	Cretaceous limestone
Kirkuk	1927	10			3	162,000	497,353,000	37	2,750	Qarah Chalk limestone
Nahr Umr	1949			1				33-40	8,300	Cretaceous sand
Qaiyarah	1927			1				15.9	840	Miocene, Cretaceous
Zubair	1949			10				33-34	10,800-11,200	Cretaceous sand
Total Iraq		10		21	4	162,000	497,353,000			

Italy

ITALIAN production operations are carried out by the government agency, Azienda Generale Italiana Petroli (A.G.I.P.), Via del Tritone 181, Rome, Italy. The Po River Valley natural-gas system of Societa Nazionale Metanodotti (S. Na. M.) consists of 674 miles of pipeline. First natural-gasoline plant for the Po Valley is scheduled to go on stream early next year. It will have a capacity of 106,000,000 cu. ft. daily, and will be owned and operated by A.G.I.P.

ITALY

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Centopozzi[1]	1923		61			11	475,519	40-42	500-1,600	Tongrain, Oligocene
Ozzano		2	1			6	21,597			
Salominore	1925	-	3			1	34,451	40-42	500-1,600	Tongrain, Oligocene
Valezza	1907	7	151			62	990,736	50	1,600-2,400	Tongrain, Oligocene
Vizzola	1942		3			7		40-42	1,900	Tongrain, Oligocene
Total Italy		9	219			87	1,522,303			

1. Scheduled to start production in 1952

Japan

ON March 17 of this year, General Headquarters of the Supreme Commander for the Allied Powers notified the operating oil companies in Japan that controls over supply and distribution of crude and refined petroleum for the Japanese civil economy were to be removed effective April 1. Companies receiving the notices were: Caltex Oil (Japan), Ltd., P.O. Box 347, Central, Tokyo; Standard-Vacuum Oil Co., P.O. Box 404, Yokohama; Shell Oil Co. of Japan, P.O. Box 401, Yokohama; Union Oil Co. of California, Tokyo; and Tide Water Associated Oil Co., Tokyo.

JAPAN

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Hachimori										
Kakurazaka										
Narahashi										
Nishuyama										
Yabase										
Total Japan						5,600	3,175,000			

Kuwait

KUWAIT OIL CO., LTD., controls production in Kuwait. It is jointly owned by Gulf Oil Corp., and Anglo-Iranian Oil Co., Ltd., London offices are at 1, Great Cumberland Place, London, W.1. Field office is at Kuwait, Persian Gulf.

KUWAIT

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Burgan	1938	92			2	570,000	365,056,474	31.8	3,500-4,800	Middle Cretaceous

1. Exclusive of 14 new wells not yet connected.

Mexico

PETROLEOS MEXICANOS (PEMEX) is the government oil agency in Mexico which controls all oil production. A company headed by Americans, Mexican American Independent Oil Co., is carrying on exploratory work. Pemex Mexico City offices are Avineda Juarez, 92 and 94, Mexico, D. F. Majority interest in Mexican American Independent is held by American Independent Oil Co., 111 Sutter Street, San Francisco.

MEXICO

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Northeastern area[1]	1931-1950	17			5	1,700	1,655,000	45-61	5,900-10,550	Oligocene-Eocene
Tampico region[1]	1901-1948	899			35	175,000	2,373,942,000	12	2,300-10,400	Cretaceous lime
Southern zone[1]	1921-1950	70	191		8	17,500	170,190,000	22-36	1,733-10,100	Miocene sand
Total Mexico		986	191		48	194,200	2,545,787,000			

(1) Estimated. (2) Includes distillate wells; Brazil, Mission and Valadeces fields.

The Netherlands

THE only company engaged in exploration and production in the Netherlands is Nederlandse Aardolie Mij., jointly owned by Royal Dutch-Shell and Standard Oil Co. (N.J.). It is headquartered at Carel van Bylandtlaan, 30, The Hague, with field offices at Oldenzaal.

THE NETHERLANDS

Name of field	Year of discovery	Number of wells: Flowing	Pumping	Shut in	Drilling	Production in bbl.: Daily average	Accumulated to July 1, 1951	Gravity A.P.I.	Producing depth (ft.)	Name and type of formation
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Schoonebeek	1943		121			13,990	17,143,300	24.8	2,900	L. Cretaceous ss.

Pakistan

ATTOCK OIL CO., LTD., controls production in Punjab, and exploration work is being carried out by Burmah Oil Co. (Pakistan Concessions) Ltd. Attock's London headquarters are at 24-28 Lombard Street, London, E.C.3., and field offices are at Pawalpindi, Punjab, Pakistan. Burmah Oil is located in Karachi, Pakistan, with London offices of the parent company at Britannic House, Finsbury Circus, London.

PAKISTAN

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Chakwal-Balkassar	1946	6			1	1,550	785,000	26	8,200	Eocene lime
Dhulian	1937							35	7,600	Eocene lime
Joya Mair	1944							22	8,200	Eocene lime
Khaur	1915							37	5,200	Eocene, Upper Tertiary ss.
Total Pakistan		6			1	3,700	785,000			

(1) Exclusive of Attock Oil Co., Ltd., production. (2) Estimated.

Peru

MAJOR operators in Peru include: International Petroleum Co., Ltd., with offices in Lima and Talara, and main headquarters at 396 Alhambra Circle, Coral Gables, Fla.; Cia. Petrolera Lobitos, 146 Dashwood House, Old Broad Street, London, E.C.2; the government agency, Empresa Petrolera Fiscale; and Ganzo Anzul (Blue Goose) Petroleum Co., with offices in Edificio San Martin, Boza 892 (P.O. Box 2560).

PERU

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Agua Caliente	1938	5	1			500	892,864	44	1,200	Middle Cretaceous sand
Cope	1938		6			19	116,899	34.6	650	Miocene sand
El Alto-Resting-Organos	1910		760		10	5,200		36	700-4,700	Eocene
La Brea-Parinas	1888	216	1,927		11	30,370	329,100,000	34.4-37.6	500-7,000	Eocene sand
Lobitos	1905		252		4	3,200		37	1,400-6,600	Eocene
Los Organos	1943		28		3	513	815,389	42.4	2,000	Eocene, Miocene
Zorritos	1863		25			34	3,585,532	34.6	2,000	Miocene, Oligocene
Total Peru		221	2,999		30	39,836	334,510,684			

Poland

Official data on oil fields and production is not currently available from Communist controlled Poland.

Qatar

PETROLEUM DEVELOPMENT (QATAR) LTD., associated with Iraq Petroleum Co., Ltd., has charge of production in this Persian Gulf peninsula. I.P.C.'s headquarters for the Middle East are at Tripoli, Lebanon.

QATAR

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Dukhan	1940	14		5		50,000	21,846,000	39.8	6,000	Jurassic

Romania

Official information on oil fields and production is not currently available from Romania. Estimates based on latest information indicate Romania's production is approximately 85,000 bbl. daily for August 1951.

Saudi Arabia

ARABIAN production is carried out through Arabian American Oil Co., whose four parent companies, Standard Oil Co. of California, The Texas Co., Standard Oil Co. (N.J.), and Socony-Vacuum Oil Co., Inc., market the oil. The headquarters of Aramco are 505 Park Avenue, New York City; its field offices at Dhahran, Saudi Arabia.

SAUDI ARABIA

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Abqaiq	1941	62		1		437,994	562,846,633	37.8	7,100	Jurassic
Abu Radriya	1940			1			9,579	34	10,115	Jurassic
Ain Dar	1947	10		12	4	126,364	22,871,888	35.2	7,100	Jurassic
Dammam	1936	31				88,830	236,249,171	35.3	4,800	Jurassic
Fadhili	1949			1				38	9,786	Jurassic
Haradh	1949			6				34	6,185	Jurassic
Qatif	1946	6		4		18,062	18,125,618	35.1	7,200	Jurassic
Uthmaniyah				1						
Total Saudi Arabia		109		26	4	671,250	840,102,889			

Trinidad

THE largest producer in Trinidad is Trinidad Leaseholds, Ltd., New York offices at 445 Park Avenue; London headquarters at 4 London Wall Buildings, London, E.C.2; and Trinidad offices in Pointe-a-Pierre. Other producing companies in Trinidad include: Antilles Petroleum Co. (Trinidad) Ltd., P.O. Box 31, San Fernando; Apex (Trinidad Oilfields, Ltd.) 208-224 Salisbury House, London Wall, London, E.C.2, and Siparia P.O., in Trinidad; Kern Trinidad Oilfields, Ltd., Kern House, 36 and 38, Kingsway, London, W.C.2, and Box 55, San Fernando; National Mining Corp., Ltd., 66, Gresham Street, London, E.C.2, and San Fernando; Trinidad Petroleum Development Co., Ltd., River Plate House, Finsbury Circus, London, E.C.2, and Siparia, Palo Seco; and United British Oilfields of Trinidad, Ltd., St. Helen's, Great St. Helen's Court, London, E.C.3, and Port Fortin.

TRINIDAD

Name of field	Year of discovery	Number of wells: Flowing	Pumping	Shut in	Drilling	Production in bbl.: Daily average	Accumulated to July 1, 1951	Gravity °A.P.I.	Producing depth (ft.)	Name and type of formation
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Barrackpore	1918	14	35			1,460		27	500-10,000	Miocene
Brighton	1910							18	700-3,000	Miocene
Coora	1936	36	71					15.6-34.7	170-8,545	Miocene
Cruse	1913	19	79			2,100		21	2,000-4,000	Miocene
Erin	1948	1				26	34,505	21.1-28.5	3,160-3,635	Miocene
Forrest Reserve	1914	127	265			14,300		24	100-8,000	Miocene
Fyzabad	1920	61	242		4	8,300	90,160,000	24	300-8,000	Miocene
Guapo									1,500-5,700	
Guayaguayare	1902	9	57			2,035		31	500-6,000	Miocene
Los Bajos	1937		14			120	3,195,691	23.4-45.6	486-6,060	Miocene
Mackenzie	1947	1	1		1	100	85,493	30.2	6,197-6,624	Miocene
Mandingo	1948	1				8	15,706	41.5	3,150-3,560	Oligocene
Morne Diablo	1936	4	20			670		25	2,500-4,000	Miocene
New Dome			9			82	2,356,732	26	1,000-2,500	Miocene
Palo Seco	1927	46	129		2	3,400	24,271,083	12.9-38.6	462-6,407	Miocene
Parrylands	1913							26	2,000-4,000	Miocene
Penal	1935	34	[2]78	4	2	6,594	19,905,000	23	9,685	Miocene, Oligocene
Point Fortin	1908	[1]68	[2]152	37	2	[3]8,075	64,390,431	20	1,000-8,000	Miocene
Quarry	1938	31	49		1	2,800	10,585,127	16.3-33.6	280-6,480	Miocene
Quinam	1936	2	11			275		31	1,500-4,000	Miocene
San Francique	1922		17			232	4,857,623	23	1,000-2,800	Miocene
T.P.D.	1926	100	267			7,600		25	1,500-6,500	Miocene
Wilson	1918	8	30			1,050		21	500-3,500	Miocene, Oligocene
Total Trinidad		662	1,526		12	59,227	219,857,391			

(1) Includes 31 on artificial lift. (2) Includes 10 on artificial lift. (3) Includes Los Bajos and Cedros.

Turkey

THE Turkey petroleum organization, Maden Tekik Ve Arama Enstitusu, is headquartered in Ankara. Exploration work has been carried out by the Turkish Institute for Mineral Research.

TURKEY

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Ramandag	1948		4	....	....	300	[1]60,000	20	4,000	U. Cretaceous lime

1. Estimated.

United Kingdom

England—Scotland

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Caunton	1943		10			20	177,000	29.3	2,000-2,200	Carboniferous, ss., ls.
Dalkeith	1938		2			3		40	1,700	Carb.-Dalkeith
Dukes Wood	1941		114			430	2,287,000	34	1,800-2,500	Carboniferous, ss., ls.
Eakring	1939		50			340	1,436,000	34	1,800-2,500	Carboniferous, ss., ls.
Formby	1939		8			4	63,000	34	85-130	Keuper ss.
Kelham Hills	1941		49			110	988,000	29.3	2,000-2,200	Carboniferous, ss., ls.
Total U. K.			233			907	4,951,000			

UNITED STATES

Production statistics on oil fields in the United States will be included in The Oil and Gas Journal's Annual Issue scheduled for publication January 28, 1952.

U.S.S.R.

Official information on Russian oil fields and production are not available. Average daily production in Russia and its dominated countries exclusive of China is reliably estimated at 800,000 bbl.

Venezuela

LEADING Venezuelan operator is Creole Petroleum Petroleum Corp., Apartado 889, Caracas, and in New York, 350 Fifth Avenue. Shell operates in Venezuela through three companies, Colon Development Co., Ltd., Venezuelan Oil Concessions, Ltd., and Shell Caribbean Petroleum Co., all having mailing addresses of Apartado 809, Caracas, Venezuela, and 50 West Fiftieth Street, New York City. Shell's London headquarters are at St. Helen's Court, Great St. Helen's, London, E.C.3. Third major leading company in Venezuela is Mene Grande Oil Co., C.A., (Gulf), Edificio Vulcania (Apartado 109, Caracas. Other operators include Socony-Vacuum Oil Co. of Venezuela, Apartado 246, Caracas, and in New York, 26 Broadway; Sinclair Oil & Refining Co., Maturin, Monagas, and in New York, 600 Fifth Avenue; Texas Petroleum Co., Apartado 267, Caracas, and in New York, 135 East 42nd Street; Venezuelan Atlantic Refining Co., Apartado 893, Caracas, and in Philadelphia, 260 South Broad Street; S. A.

Venezuela (continued)

Petrolera Las Mercedes (Texaco and Ultramar), Apartado 1426, Caracas; Phillips Oil Co., Apartado 1031, Caracas, and in New York, 80 Broadway; and Richmond Oil Co., (Standard Oil Co. of California), Apartado 221, Caracas, and in San Francisco, 225 Bush Street.

VENEZUELA

Anzoategui

Name of field	Year of discovery	Number of wells: Flowing	Pumping	Shut in	Drilling	Production in bbl: Daily average	Accumulated to July 1, 1951	Gravity °A.P.I.	Producing depth (ft.)	Name and type of formation
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Anaco	1940			1			15,317	43.4	10,000	Miocene, Oligocene
Aragua	1950	4				780	248,295	54.3	9,000	Oligocene sand
Cacio Seco Block[1]	1946	5				850	1,074,544	43	6,560-7,300	Miocene, Oligocene
Cerro Pelado	1951		1		1	150		39	4,400	Miocene, Oligocene
Chaparro	1951							44	5,300	Miocene, Oligocene
Chimire	1948		117		4	60,793	32,443,179	36-36.7	7,000-7,200	Miocene, Oligocene
Dacion	1951	26			3	10,700	1,728,320	21	6,700	Miocene, Oligocene
El Roble	1939	41			1	6,700	30,015,201	52.2	8,040-11,560	Miocene, Oligocene
El Toco-Apamate	1948		6		1	2,900	2,160,875	40	9,000	Eocene
Freites	1949			1			14,000	30.7	9,346-9,588	Miocene, Oligocene
Fria	1947	3				650	1,102,683	37	6,200	Miocene
Guard Block[2]	1942	169	45		1	57,300	165,166,268	34	6,700	Miocene, Oligocene
Guario	1940	22			2	5,509	14,392,471	44.2	5,000-10,000	Miocene, Oligocene
Guere	1951	3	3		1	2,200	176,156	37.2	7,380-8,000	Oligocene
Guico	1944	33				9,142	24,389,703	40.4	4,500-7,000	Miocene
Guico (West)	1946	6				1,129	2,527,777	34.5	4,500-7,000	Miocene
Guico (South)	1946	7				993	4,263,829	35.1	4,500-6,200	Miocene
Inca	1948	2	....	....	....	400	265,836	41	7,100	Miocene, Oligocene
La Ceiba	1946			1			254,847	36	7,700	Oligocene
Leona Block[3]	1938	20	5			5,876	13,569,651	28	8,000	Miocene, Oligocene
Los Mangos	1950	1				350	61,827	35	8,100	Oligocene
Los Ollas	1942			1			5,000	42	7,300-7,400	Miocene sand
La Vieja	1951	1	....	....	1	100	15,881	23	2,500	Eocene, Oligocene
Muri	1942	10	41			1,900	12,638,314	27.2	3,200-5,000	Miocene
Nipa Block[4]	1945	130	1		1	50,860	47,070,992	14-44	6,000-8,500	Miocene
Oficina Block[5]	1935	133	117		2	56,040	178,951,474	35	5,900	Miocene, Oligocene
Pelayo	1947			2			245,810	32	7,400	Oligocene
Quiamare	1942			1			702,592	38	7,000	Miocene, Oligocene
Rincon Largo	1941	4				1,625	4,679,707	43	6,500-8,000	Oligocene
San Joaquin	1939	38			....	7,500	33,786,000	45.6	4,830-9,500	Miocene
San Rogue-La Loma	1939-1950	38			1	3,618	3,851,556	51.1	8,500	Oligocene
Santa Ana	1936	13			2	4,800	4,638,130	41	8,500	Miocene, Eocene, Oligocene
Santa Rosa	1941	13	....	....	....	3,600	7,942,578	43	11,000	Miocene, Eocene, Oligocene
Socoroco	1940			1			12,000	27	4,400-4,020	Miocene, Oligocene
Soto Block[6]	1948	14			6	7,476	2,193,844	31	10,000	Miocene
Yopales Block[7]	1937	11	5			3,400	4,262,103	26	4,600	Miocene, Oligocene

Delta Amacuro

Pedernales	1933	17			1	11,900	18,165,000	21.9	1,380-6,380	Miocene sand
Tucupita	1945	40				9,886	10,750,294	16	5,600	Miocene

Falcon

Cumarebo	1913	13	36		1	3,700	43,053,000	48.1	600-2,100	Miocene
Hombre Pintado	1927		28		1	540	4,786,620	25	600-1,850	Miocene
Las Palmas[8]	1928						381,000	33	2,100-5,400	Miocene-Oligocene sand
Mene de Mauroa[9]	1921	1	24		1	413	24,901,753	33	1,000	Miocene sand
Silvestre	....			4		100		24	9,763	Eocene

Guarico

Cocomon	1951	2			1		170	58	6,700	Oligocene
Grico	1946			1				30	4,100	Oligocene
Guavinita	1948	10			1	1,150	767,164	30	3,500	Oligocene
Las Mercedes[10]	1941	138			4	5,650	13,105,735	26-36	4,160-5,650	Oligocene
Monal	1951	2				25		39	3,700	Oligocene
Palacio	1946	45				5,370	5,441,634	30	3,400	Oligocene
Piragua	1949			1				41	3,000	Oligocene
Ruiz	1949	49	10		1	9,400	4,050,079	31.5	1,600-4,600	Oligocene
Saban	1947	3	7		1	520	268,265	32	800-4,000	Oligocene
Taman	1949	15	7			5,325	4,730,953	39		Miocene
Tucupido-Taman	1947	38	10		1	9,100	12,089,722	39.5	2,500-5,500	Oligocene

Monagas

Capacho	1945						7,000	23.1	4,400-4,500	Oligocene
Jusepin	1938	216	46			22,516	132,008,009	32.9	3,000-5,300	Miocene sand
Los Caritos	1939						255,833	30	5,641	Miocene, Oligocene
Mata Grande	1946	14	6			1,900	2,331,093	27.5	5,326	Miocene sand
Merey	1937	2	1			600	444,754	19	5,700	Pleistocene
Mulata	1941	168	94			23,500	92,553,072	35.4-35.8	3,500-6,660	Miocene sand
Oracual	1933						30,000	13	2,600-3,190	Miocene, Pliocene
Pilon-Lapa	1936						14,000	14	3,370-4,100	Miocene
Pirital (Auipa)	1945					100		30-35		Miocene
Quiriquire	1928	13	425		1	76,800	364,093,000	17.1	690-5,100	Pliocene
Santa Barbara	1941	128	69			15,241	70,112,886	32-33	3,450-6,930	Miocene
Temblador[11]	1936	82				8,900	36,948,000	21.2	3,310-4,500	Miocene, Oligocene
Travieso	1944		9			240	997,629	26.8	4,000	Miocene
Uracoa	1937							15	4,290-4,380	Miocene, Oligocene

VENEZUELA (Continued)

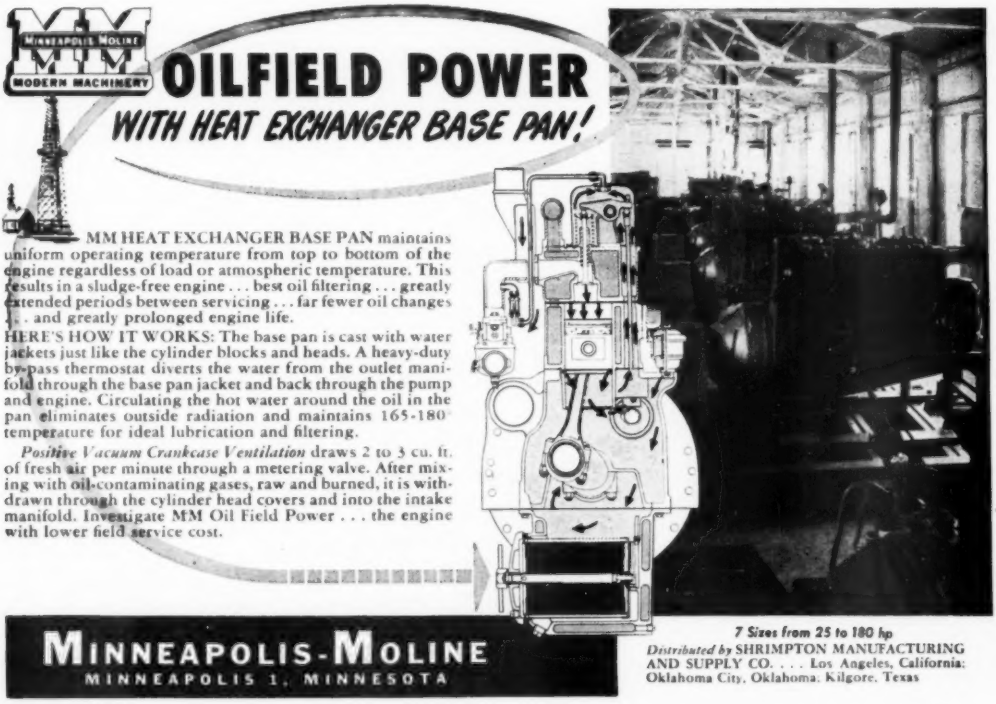
Zulia

Name of field (1)	Year of discovery (2)	Number of wells: Flowing (3)	Pumping (4)	Shut in (5)	Drilling (6)	Production in bbl.: Daily average (7)	Accumulated to July 1, 1951 (8)	Gravity A.P.I. (9)	Producing depth (ft.) (10)	Name and type of formation (11)
Albaricos	1947			1				11	7,000	Oligocene, Eocene sand
Alturitos	1950			1			9,000	20.3	12,022-12,058	Paleocene sand
Bachaquero	1930	542	294		9	158,655	228,623,499	13-15	5,400	Miocene sand
Boscan	1946		39			13,813	8,575,809	10-11	6,500-7,500	Eocene sand
Cabimas[12]	1924	143	789		1	83,919	654,220,919	15-25	2,200-3,000	Miocene, Oligocene
El Cubo[15]	1916	28	101			12,560		33	984	Eocene
El Menito	1925			1			6,670	15	2,000	Eocene
Ensenada	1946	1				350	110,000	39	7,800	Eocene sand
La Concepcion[14]	1935	2	75		2	3,824	35,816,257	36	3,148	Eocene sand
Lagunillas[15]	1926-1948	360	1,122		7	416,000	1,984,970,047	17-34	3,000-8,000	Miocene, Eocene
La Paz	1925	45	11			166,759	241,529,289	34	4,264	Eocene
Los Barrossos	1922			1			96,000	16-22	684-982	Eocene
Mocoa	1948			2				22	9,000	Cretaceous lime
Mara	1945	30	6		9	77,116	99,342,370	30	6,000-9,500	Cretaceous
Mene Grande[16]	1914	7	355		1	46,995	363,631,248	16-18	4,132	Eocene
Misoa	1921			1			8,000	15	518-908	Eocene sand
Netick	1928			1			105,402	28	6,000	Eocene
Pueblo Viejo	1940	7	12			4,299	11,970,404	18-20	1,968-2,500	Eocene
San Jose	1948			1				11.4	10,650	Eocene sand
Sibucara	1948	1			2	8,067	7,141,531	36	13,451	Cretaceous lime
Tia Juana	1928	176	652		1	187,441	693,086,815	13-26	3,000	Miocene, Oligocene
Totumo	1914			1			150,000	20	1,500-3,100	Igneous fault
Total		3,085	4,569	24	73	1,730,015	5,766,526,876			

(1) Includes: CAM-1, CAXM-201, CAM-301 and Tagua fields. (2) Includes: W. Guara, E. Guara, GM-4, Airport, GM-14, GM-2, GS-4, GS-13, GS-20, and G-5-21 fields. (3) Includes: LV-1, LXG-101, and LXM-201 fields. (4) Includes: W. Nipa, E. Nipa, Antonio (NS-201), NS-119, NZ-401, and Chive fields. (5) Includes: Offincia, Aventazon, OG-202, OM-6, OS-11, OS-31, OZ-4, OG-168, and OG-286 fields. (6) Includes: Mapiri, Soto-1, E. Soto, and Boco fields. (7) Includes: YS-1, Agua Clara, YS-14, Moquete, and Caris fields. (8) Includes: Monte Claro, Urumaco. (9) Includes: Media. (10) Includes: Placera. (11) Includes: Tabasca. (12) Includes: La Rosa, Pinta Benitez, Amberosio. (13) Includes: Las Cruses, Tarra, West Tarra, Los Manueles, Rio de Oro. (14) Includes: Cacuz. (15) Includes: Concession Lacustre. (16) Includes: Zulod, Pauji.

Yugoslavia

Reliable data on oil-field operations in Yugoslavia are not currently available.


MINNEAPOLIS MOLINE
MM
MODERN MACHINERY
OILFIELD POWER
WITH HEAT EXCHANGER BASE PAN!
MM HEAT EXCHANGER BASE PAN maintains uniform operating temperature from top to bottom of the engine regardless of load or atmospheric temperature. This results in a sludge-free engine . . . best oil filtering . . . greatly extended periods between servicing . . . far fewer oil changes . . . and greatly prolonged engine life.
HERE'S HOW IT WORKS: The base pan is cast with water jackets just like the cylinder blocks and heads. A heavy-duty by-pass thermostat diverts the water from the outlet manifold through the base pan jacket and back through the pump and engine. Circulating the hot water around the oil in the pan eliminates outside radiation and maintains 165-180° temperature for ideal lubrication and filtering.
Positive Vacuum Crankcase Ventilation draws 2 to 3 cu. ft. of fresh air per minute through a metering valve. After mixing with oil-contaminating gases, raw and burned, it is withdrawn through the cylinder head covers and into the intake manifold. Investigate MM Oil Field Power . . . the engine with lower field service cost.
MINNEAPOLIS-MOLINE
MINNEAPOLIS 1, MINNESOTA
7 Sizes from 25 to 180 hp
Distributed by SHRIMPTON MANUFACTURING AND SUPPLY CO. . . . Los Angeles, California; Oklahoma City, Oklahoma; Kilgore, Texas

Refining-Output Gains Elsewhere Balance Loss Incurred by Abadan Shutdown

by R. B. Tuttle

GAINS in refining capacity in the United Kingdom and in the free countries of Europe in 1951 offset losses incurred through the shutting down of the world's largest refinery at Abadan, Iran. This huge plant's throughput rating of 500,000 bbl. daily, placed on idle status only a few months ago, is balanced out approximately by equal increases in European countries and United Kingdom refineries.

Further plant increases in Europe and the United Kingdom, scheduled for operation in 1953 and 1954 amount to approximately 95,000 bbl. daily. This increase is accounted for in seven projects which include three new refineries and increases to four existing plants. The principal one in this group is a new 25,000-bbl. per day refinery in Belgium scheduled to go into operation in 1953. The other new refineries nearing final stages of planning are scheduled for Italy and Denmark. The Italian plant is rated at 18,000 bbl. daily with the Denmark plant at 2,000 bbl. daily. Refinery increases in this 1953-1954 group include plants in England, Germany, Italy, and France.

In other sections of the Eastern Hemisphere plans are under way for upping world refining capacity by 100,000 bbl. daily. This capacity is included principally in projects scheduled for refineries in Africa and Asia. Important among these projects are three new refineries, one in the Philippines and the other two in India. These projects involve new refineries of approximately the same ratings, currently set at 20,000 bbl. daily.

Another important new refinery is scheduled for South Africa. This plant, rated at 15,000 bbl. daily, will be South Africa's first to process crude oil. The only refinery now operating in this area processes shale oil.

In South America, Chile is planning the construction of its first modern refinery. This new plant is scheduled to go on stream in 1953. Chile's previous refining capacity was small, being made up of small skimming plants which have been on inoperative status for some time. The new refinery is rated at 18,000 bbl. daily.

Other projects in South America include two new plants for Brazil and a capacity increase for one of the plants in Venezuela. The larger of Brazil's new plants has a capacity rating of 10,000 bbl. daily and is scheduled for operation in 1953. Capacity rating of Brazil's other new plant is 2,500 bbl. daily. Increase to Venezuela's refining capacity involves 65,000 bbl. daily and is scheduled to go into operation also in 1953.

The over-all world refining capacity picture through 1954 indicates nearly 1,000,000 bbl. daily is involved. This capacity increase, plus current increases, exclusive of North America and U.S.S.R. and its satellites, is about 20 per cent over 1950.

Summary of World-Wide Refining Activity

Country—	Number of operating refineries	Bbl. per day— Crude-oil capacity	Cracking capacity
Argentina	16	171,050	63,900
Australia	4	21,100	1,500
Austria*	7	25,000	
Bahrein Is.	1	155,000	61,200
Belgium	7	49,900	18,800
Bolivia	3	10,500	
Brazil	3	10,800	4,500
Burma	1	2,000	.....
Canada	38	424,400	222,150
Canary Islands	1	25,000	5,000
China*	1	1,000	300
Colombia	2	37,000	
Cuba	6	7,800	1,400
Denmark	3	620	
Ecuador	2	4,700	
Egypt	2	47,000	6,400
Eire	1	600	
Formosa	1	16,850	2,000
France	13	404,600	77,160
French Morocco	1	1,500	
Germany	22	114,350	24,500
Hungary*	8	20,000	
India	1	5,750	1,500
Indonesia-British Borneo	5	206,500	56,000
Iran†	2	502,500	100,000
Iraq	2	9,500	
Israel	1	85,500	36,400
Italy	16	170,600	27,050
Japan	17	85,600	85,000
Kuwait	1	25,000	
Lebanon	1	10,000	
Mexico	8	178,350	25,900
Netherlands	2	128,500	59,900
Norway	1	1,000	
Pakistan	1	4,800	2,000
Peru	3	38,000	4,000
Poland*	6	7,000	
Portugal	1	10,000	
Romania*	16	200,000	50,000
Saudi Arabia	1	160,000	23,500
Spain	2	23,700	8,200
Sweden	3	23,800	1,000
Switzerland	1	4,000	
Turkey	1	1,400	
United Kingdom	12	502,500	59,400
United States	346	7,026,490	2,331,880
U.S.S.R.*	28	750,000	300,000
Uruguay	1	25,200	2,200
Venezuela	13	321,020	74,500
West Indies	6	760,000	471,000
Yugoslavia*	5	8,000	
Total world	646	12,825,480	4,208,240

*Reliable data on current refining operations in U.S.S.R. and in areas under Communist domination are not available. Number of refineries and capacities listed for these countries are based on estimates.

†Operations suspended.

Journal's International

SURVEY OF OIL REFINERIES

ABBREVIATIONS: S—skimming; C—cracking; A—asphalt; L—lubricating oil; W—Wax; Comp.—all the principal products.

ARGENTINA

Company and address—	Refinery location	Type of plant	Crude-oil capacity (bbl. daily)	Cracking capacity (bbl. daily)
Cia. Condor, Levalle 27, Avellaneda	Avellaneda	S	900	
Cia. General Asfaltos, Buenos Aires	Buenos Aires	S	400	
Cia. La Isura, S. A., Av. Pte. R. S. Pena 699, Buenos Aires	Bahia Blanca	S-C	2,000	1,000
Diadema Argentina, S. A., de Petroleo, Roque 788 Saenz Pena, Buenos Aires	Buenos Aires	S-C	17,000	[1]12,000
Esso Productora de Petroleo, S. A. Ava. R. Saenz Pena 567, Buenos Aires	Dadin	S	400	
Esso Refinadora de Petroleo, S. A., Ava. R. Saenz Pena 567, Buenos Aires	Manuel Elordi	S	1,250	
	Campana	Comp.	22,500	10,000
Lottero y Papinia, Avellaneda	Bahia Blanca	S-C-A	5,500	2,200
Ultramar, S. A., Petrolera Argentina, Av., Alem 619, Buenos Aires	Avellaneda	S	300	
Yacimientos Petroliferos Fiscales,[2] Av. Roque Saenz Pena 777, Buenos Aires	Avellaneda	S-C	6,000	2,500
	Comodoro Rivadavia	S-C	5,500	2,000
	La Plata	S-C	85,000	25,000
	Mendoza	S-C	5,000	3,000
	Plaza Huincul	S	1,300	
	Salta	S	2,000	
	San Lorenzo	S-C	16,000	6,200
Total Argentina			171,050	63,900

(1) Includes 3,000 bbl. daily reforming capacity. (2) Estimated.

AUSTRALIA

Bitumen & Oil Refineries (Australia), Ltd., P.O. Box 1, Matraville	Matraville	S-A	8,000	[1]1,500
Commonwealth Oil Refineries, Ltd., Scottish House, 90 William St., Melbourne	Laverton	S	2,500	
National Oil Proprietary, Ltd., Glen Davis 6 W. New South Wales	Glen Davis	[2]		
The Shell Co. of Australia, Ltd., Shell Corner, 163 William St., Melbourne	Clyde	S-A	[3]8,800	
Vacuum Oil Pty., Ltd., 29 Market St., Melbourne C. 1	Altona	S-A	[4]1,800	
Total Australia			[5]21,100	1,500

(1) Platforming unit under construction. (2) Shale oil plant. (3) Includes 900 bbl. daily topped crude-oil capacity. Capacity to be increased to 18,000 bbl. daily by 1954. (4) Refinery expansion planned. Propect to include catalytic cracking and increase of distillation facilities to 14,000 bbl. daily. (5) California Texas Corp. plan to build a complete 22,000 bbl. daily refinery in Sydney area.

AUSTRIA

Latest reliable information on refining operations in Austria show seven operating and two shutdown plants in Austria. Estimated capacity for the nine refineries is 26,000 bbl. daily. Approximately 25,000 bbl. of daily refining capacity in this occupied country are in the Russian zone.

BAHREIN ISLAND

Bahrein Petroleum Co., Ltd., 551 Fifth Ave., New York 17, U.S.A.	Bahrein	S-C-A	155,000	[1]61,200

1. Includes 19,500 bbl. daily reforming capacity and 10,200 bbl. daily of additional catalytic cracking scheduled for completion in 1952.

BELGIUM

"Albatros" S. A., Belge Pour le Raffinage de Petrole, 10 Petroleumkaai, Antwerp-Kiel	Antwerp-Kiel	S	3,500	(1)
Belgian Shell Co., S. A., 47 Cantersteen, Brussels	Ghent	(2)		
Compagnie Industrielle "Atlas," S. A., 101 Ave. de France, Antwerp	Hoboken-Antwerp	S	2,000	
Esso Standard Refinery, S. A., 101 Ave. de France, Antwerp	Atlas	S	[3]2,000	
Raffinerie Belge de Petroles, S. A., 115 Ave. de France, Antwerp	Antwerp	S-C-L	12,500	[4]2,200
Raffinerie et Distilleries Anversoises, Antwerp	Antwerp	S	1,700	
Ste. Industrielle Belge des Petroles, S. A., P. O. Box 55, Antwerp	Antwerp	S-C	27,000	[5]16,600
Tankage et Transport, S. A., 10 Palace Leopold, Antwerp	Antwerp-Kiel	S	1,200	
Total Belgium			49,900	18,800

(1) Plans call for installation of 4,200 bbl. daily catalytic cracking unit. (2) Process topped crude oil. (3) A 25,000 bbl. daily capacity refinery now under construction. Completion scheduled 1953. (4) Includes 1,200 bbl. daily reforming capacity. (5) Includes 5,400 bbl. daily reforming capacity.

BOLIVIA

Yacimientos Petroliferos Fiscales Bolivianos, Ave. Gral. Camacho y Bueno, La Paz	Camiri	S	1,500	
	Cochabamba	S	5,000	
	Sucre	S	4,000	
Total Bolivia			10,500	

INTERNATIONAL REFINERY SURVEY

BRAZIL

Company and address—	Refinery location	Type of plant	Crude-oil capacity (bbl. daily)	Cracking capacity (bbl. daily)
Conselho Nacional do Petroleo, Av. Presidente Wilson, 164 Rio de Janeiro	Cubatao	S-C	(1)	(1)
	Mataripe	S-C	[2]5,000	2,500
Industrias Matarazzo de Energia, S. A., Predio, Conde Matarazzo, Sao Paulo	Sao Paulo	S-W	1,000	
"Ipiranga," S. A., Cia. Brasileira de Petroleos, Rio Grande	Rio Grande	Comp.	[3]4,800	2,000
Refinaria de Petroleos de Manguinhos, S. A., Rua Marechal Floriano No. 6, Rio de Janeiro	Rio de Janeiro	S-C	(4)	(4)
Total Brazil			10,800	4,500

(1) New refinery, 2,500 bbl. daily capacity under construction. (2) Includes 2,500 bbl. daily capacity under construction. (3) Includes 3,500 bbl. daily capacity under ocnstruction. (4) New refinery, 10,000 bbl. daily crude-oil capacity and 7,330 bbl. thermal cracking capacity daily under construction.

BURMA

Burmah Oil Co., Ltd., Brittanic House, Finsbury Circus, London E. C. 2, England	Chauk	S	2,000	

CANADA

A detailed list of Canada's 38 operating refineries was published in the Annual Refining Issue of The Oil and Gas Journal, March 29, 1951, page 339. This survey included all nations in North America. The January 1, 1952, survey will be published March 17, 1952

Total Canada			424,400	222,150

CANARY ISLANDS (SPAIN)

Cia. Espanola de Petroleos, S. A., Alcala 31, Madrid	Sta. Cruz de Tenerife	Comp.	25,000	5,000

CHILE

Empresa Nacional del Petroleo, Ramon Nieto 920, Santiago	Santiago	S-C	(1)	(1)

1. Refinery under construction. Daily capacity: crude oil 18,000 bbl.; thermal cracking 9,700 bbl.; reforming 3,700 bbl.

CHINA

Because of political situation in China no reliable information on country's current refining industry is available. Latest information shows a topping-cracking plant of 1,000 bbl. daily capacity located in Kansu province.

COLOMBIA

Colombian Petroleum Co., Cucuta	Petrolea	S	900	
Tropical Oil Co., El Centro	Barranca-Bermeja	S-A-L	28,000	(1)
Total Colombia			37,000	

1. A 35,000 bbl. daily catalytic cracking unit is being considered for refinery.

CUBA

Cia. Explorado de Petroles, Jarahueca	Jarahueca	S	400	
Cia. Petrolea Jarahueca, Jarahueca	Jarahueca	S	600	
Cuban Oil Refining Co., Cabaiquan	Cabaiquan	S	800	
Distiladora Jarahueca, Jarahueca	Santa Clara	S	200	
Esso Standard Oil Co. (Cuba), Apartado 1303, Havana	Belot	Comp.	5,500	1,400
Union Gas Co., Bacuranao	Bacuranao	S	300	
Total Cuba			7,800	1,400

DENMARK

Dansk Mineraloliefabrik, Copenhagen	Copenhagen	S-L	50	
A/S Kalundborg Olieraffinaderi, Sankt Annae Plads 13, Copenhagen	Klundborg	A	500	
L. C. Glad Co., A. S., Copenhagen	Copenhagen	S	70	
Total Denmark			[1]620	

1. A Danish group headed by A. P. Moeller is planning to build a 2,000 bbl. daily refinery near Copenhagen.

ECUADOR

Anglo-Ecuadorian Oilfields, Ltd., Casilla 410, Guayaquil	La Libertad	S	4,000	
Manabi Exploration Co., Inc., Apartado 4075, Guayaquil	Cautivo	S	700	
Total Ecuador			4,700	

EGYPT

Anglo-Egyptian Oilfields, Ltd., St. Helen's Court, London, E. C. 3, England	Suez	S-C-A	[1]38,000	6,400
Raffinerie de Petrole du Government, 18 Rue Fouad Ier, Alexandria	Suez	S	[2]9,000	
Total Egypt			47,000	6,400

(1) Current intake 40,000 bbl. daily. (2) Long range expansion program scheduled to increase capacity to 28,000 bbl. daily.

EIRE

Cork Harbour Oil Wharves, Ltd., 146 Dashwood House, Old Broad St., London E. C. 2, England	Haulbowline Is.	S	600	

FORMOSA

Chinese Petroleum Corp.	Kaoshiung Tiawan	S-C-A	16,850	2,000

FRANCE

Cie. Francaise de Raffinage, 11 Rue du Doctor Lanceraux, Paris 8	Gonfreville l'Ocher	Comp.[1]	65,000	[2]12,600
	La Mede	S-C-W	50,000	[3]14,000
Cie. de Raffinage Shell-Berre, 29 Rue de Berre, Paris 8	Berre L'Etang	Comp.	63,000	[4]7,000
	Petit-Couronne	Comp.	35,000	[5]8,400
	Pauillac	S-A	[6]6,300	

FRANCE (Continued)

Company and address	Refinery location	Type of plant	Crude-oil capacity (bbl. daily)	Cracking capacity (bbl. daily)
Pechelbronn S. A., d'Explorations Minieres, 1 Rue Leon Jost, Paris 17	Merkwiller	Comp.	1,700	230
Raffineries Francaises des Petroles de Atlantique, Donges-St Nazaire	Donges	S-C	25,000	3,800
Ste. de Raffineries de Petrole de la Gironde, 7 Palace Vendome, Paris	Bec d'Ambes	S-C	16,500	3,500
Ste. General des Huiles de Petrole, 21 Rue de la Bienfaisance, Paris 8	L'Avera	S-C	34,000	4,400
	Dunkerque	Comp.	[1]29,300	[11]
Socony-Vacuum Francaise, 46 Rue de Courcelles, Paris 8	Notre Dame de Gravenchon	Comp.	17,300	[12]3,140
	Frontignan	S-C	25,500	[13]14,290
Standard Francaise des Petroles, S. A., 82 Champs Elysees, Paris 8	Notre Dame de Gravenchon	Comp.	[14]36,000	[15]5,800
Total France			406,600	77,160

(1) Lube-oil plant and 11,000-bbl. catalytic cracking unit under construction. (2) Includes 4,000 bbl. daily reforming capacity. (3) Includes 11,000 bbl. daily reforming capacity. (4) Includes 2,800 bbl. daily reforming capacity. (5) Includes 3,500 bbl. daily reforming capacity. (6) Refinery capacity to be increased to 15,000 bbl. daily late in 1952. (7) Includes 3,800 bbl. daily reforming capacity. A 10,000 bbl. daily catalytic cracking unit to be placed in operation during 1953. (8) Reforming capacity. (9) Reforming capacity. (10) Includes 20,800 bbl. of daily capacity under construction. (11) Under construction; 5,000 bbl. daily reforming capacity. (12) Reforming capacity. (13) Includes 11,150 bbl. daily catalytic cracking and 3,140 bbl. daily reforming capacities. (14) Under construction; 11,750 bbl. daily catalytic cracking unit and lube-oil facilities. (15) Reforming capacity.

FRENCH MOROCCO

Ste. Cherifienne des Petroles, Petitjean	Petitjean	S.	1,500	

GERMANY

Badische Anilin & Soda-Fabrik, Ludwigshafen-Oppau	Ludwigshafen	S-L-W	950	
BP Benzin und Petroleum, Gesellschaft, 5 Steinstrasse, Hamburg	Hamburg	S-C	13,100	6,700
Coelner Benzin Raffinerie Gmbh., Cologne	Cologne	(1)		
Deutsche Erdoel, A. G., Heide (Holstein)	Heide	S-L-A	2,000	
	Hamburg-Grasbrook	(2)		
	Wietze	S-L-A	950	
Deutsche Gasolin, A. G., Hanover, Jordan-Str. 32	Dollbergen	S-L-A	2,000	
Deutsche Shell A. G., Shell Haus, Hamburg 36, Alster Ufer 45	Harburg-Wilhelmsburg	S-L-A	[3]10,200	
	Monheim-Reisholz	S-L-A	4,000	
Deutsche Vacuum Oel, A. G., Bartholomay Haus, Steinstrasse 5-7 (24a), Hamburg	Bremen-Oslebshausen	S-L-W	12,000	
Ebano Asphalt Werke, A. G., Neuer Jungfernsteig 21, Hamburg	Hamburg-Harburg	S-A	12,500	
Gelsenberg Benzin, A. G., Gelsenkirchen	Gelsenkirchen	S-C	14,400	6,500
Georg Greiser, Hannover	Dollbergen	S-L	120	
Gewerkschaft Deurag-Werag	Misburg	Comp.	10,500	3,600
Johann Haltermann, Hamburg	Wilhelmsburg	(4)		
Kraftstoff-Handelsgesellschaft mbH. (Schieweck Bros.)	Essen-Altenessen	S.	700	
Mineraloelwerke, Albert Sengewald, Dedenhausen-Hannover	Dedenhausen	S-L.	470	
Mineraloel and Asphaltwerke, A. G., MAWG, Hamburg 1, Ferdinanstr. 29-31	Ostermoor	S-A	1,150	
Oelwerke Julius Schindler, G.m.b.H., Hohe Bleichen 28, Hamburg 36	Peine	S-L	450	
Rhurbau, G.m.b.H., Muelheim on Ruhr	Hamburg	S-L	3,300	
	Muelheim	S.	2,000	
Rhurchemie, A. G., Oberhausen-Holton	Oberhausen	S-C	[5]6,000	[2]2,500
Union Rheinische Braunkohlen-Kraftstoff, A. G., Cologne	Wesseling	S-C	16,000	5,200
Wintershall, A. G., Emsland	Salzbergen	S-L-W-A	1,400	
Zeller and Gmelin, Wuerttemberg	Eislingen	S-L.	160	
Total Germany			114,350	24,500

(1) Includes 600 bbl. daily topped crude oil and various distillates capacity. (2) To be expanded to 32,000 bbl. daily by 1954. (3) Hydrogenation capacity. (4) Under construction.

HAWAIIAN ISLANDS

Pacific Refiners, Ltd., Honolulu	Honolulu	(1)		

1. Asphalt refinery operating on mixture of reduced or heavy crude oil and butane which is imported.

HUNGARY

Reliable information on refining operations in Hungary is not currently available. Latest reports show this country had eight refineries with a total capacity of approximately 20,000 bbl. daily.

INDIA

Assam Oil Co., Ltd., Britannic House, Finsbury Circus, London, England	Digboi	Comp.	5,750	1,500
Standard-Vacuum Oil Co.	Bombay	(1)		
Total India			5,470	1,500

1. Plans under consideration to build 20,000 bbl. daily refinery. Burmah Oil Co., Ltd., and Caltex Petroleum Corp. also have plans to build refineries in India.

INDONESIA-BRITISH BORNEO

N.V. de Bataafsche Petroleum Mij., Carl Van Bylandtlaan 30, The Hague, Netherlands	Balik Papan, Borneo	S-W	27,000	
	Tjepoe, Java[1]	S		
	Wonokromo, Java	S-A	2,000	
	Pangkalan Brandan, Sumatra	(2)		
	Pladju, Sumatra	S-C	75,000	25,000
Sarawak Oilfields, Ltd., Miri, Sarawak	Lutong, Sarawak	S	38,500	
Standard Vacuum Petroleum, Mij., Sungei Gerong, Sumatra	Sungei Gerong, Sumatra	S-C-W	64,000	31,000
Total Indonesia-British Borneo			206,500	56,000

(1) Damaged during political disturbances; portion of facilities being rehabilitated. (2) Inaccessible. (3) Includes 15,000 bbl. daily reforming capacity of which 7,500 bbl. daily are inoperative.

IRAN

Company and address	Refinery location	Type of plant	Crude-oil capacity (bbl. daily)	Cracking capacity (bbl. daily)
Anglo-Iranian Oil Co., Ltd., Britannic House, Finsbury Circus, London, England	Abadan[1]	Comp	500,000	[2]100,000
Kermanshah Petroleum Co., Ltd., Britannic House, Finsbury Circus, London, England. (Now controlled by government of Iran.)	Kermanshah	S	2,500	
Total Iran			502,500	100,000

(1) Operations suspended. (2) Includes 25,000 bbl. daily catalytic cracking capacity.

IRAQ

Iraq Petroleum Co., Ltd., 214 Oxford St., Oxford Circus, London W. 1, England	Baba Gurgur	S	1,500	
Khanaquin Oil Co., Ltd., Britannic House, Finsbury Circus, London, E. C. 2, England	Alwand	S	8,000	
Total Iraq			9,500	

ISRAEL

Consolidated Refineries, Ltd., Britannic House, Finsbury Circus, London E. C. 2, England	Haifa	S-C	[1]85,500	36,400

1. Refinery currently operating on 16,500 bbl. daily crude-oil input.

ITALY

"Aquila" Societa Tecnico-Industriale, Casella Postale 582, Trieste	Trieste	S-L	10,000	
Industrie Chimiche Italian del Petroleo, Mantoue	Montoue	S-C	[1]6,000	[2]2,500
Industrial Raffinazione Oli Minerali, via Castella Postale 479, Venice	Venice	S-C	[3]26,000	6,000
Lombardi Petroli, Villasanta	Villasanta	S	2,000	
Permolio Raffinerie Italiane Oli Minerali	Genoa	S-C	2,500	1,600
	Milan	S	2,500	
	Rome	S-C	1,700	1,600
Petroli D'Italia, S.p.A., via Meravigli No. 7, Milano	Piacenza	S-C	3,200	[4]600
Raffinerie Siciliane Oli Minerali, S. A., Augusta, Sicily	Megara	S	12,000	
Societa per Azioni Raffineria Padana Olii Mineral, Piazza San Sarlo 161, Turin	San Martinodi	S-C	[3]13,300	[3]3,150
Societa per l'Industria Italiana del Petrolio, Casella Postale 810, Genoa	La Spezia	S-C-A	[5]18,600	1,600
Societa Petrolifera Italiana, Fornovo-Taro	Fornovo	S	400	
Socony-Vacuum Italiana S.p.A. 26 Broadway, New York 4, N. Y., U. S. A.	Naples	Comp	33,000	5,000
Standard-Italo Americana Petroli, via Assarotti 40, Genoa	Trieste	S-L-A	2,400	
Staniac-Industria Petrolifera S.p.a., Corso d'Italia 39A, Rome	Bari	S-C-A	25,000	3,500
	Leghorn	Comp	[6]12,000	1,500
Total Italy			170,600	27,050

(1) Includes 2,500 bbl. daily reforming capacity. (2) Expansion planned for 1952. Program includes 10,800 bbl. daily atmospheric-vacuum unit, reformer, poly plant, and lube facilities. (3) Catalytic cracking unit, 1,600 bbl. daily capacity, under construction. (4) Naphtha reforming capacity. (5) Under construction. (6) Includes topped crude oil capacity and some cracking facilities. Ultimate capacity 30,000 bbl. daily in 1953. (7) New 20,000 bbl. daily crude-oil pipestill under construction.

JAPAN

Daikyo Oil Co., Ltd.	Yokkaichi	S-L	6,000	
Koa Oil Co., Ltd., No. 12, 2 Chome Marunouchi Chiyoda-ku, Tokyo	Marifu	S-C-L	[1]10,000	2,500
Maruzen Oil Co., Ltd., No. 2 Mita-Shikoku-Machi, Shiba, Minato-ku, Tokyo	Matsuyama	S	4,000	
	Shimotsu	S-L-W	[2]9,000	
Mitsubishi Oil Co., Ltd., No. 1 Kotohiracho, Shiba, Minato-ku, Tokyo	Kawasaki	Comp.	6,100	2,500
Nippon Mining Co.	Funakawa	S	5,000	
Nippon Oil Co.	Akita	S	2,000	
	Niigata	S	1,500	
	Kashiwazaki	S	2,000	
	Garugawa	S	200	
Nippon Petroleum Refining Co., 3-10 Chome, Marunochi, Chiyoda-ku, Tokyo	Kudamatsu	S-L-W-A	7,000	
	Yokohoma	S-L-W-A	[3]7,000	
Taiyo Oil Co.	Shikoku Island	[4]		
Showa Oil Co.	Kawasaki	S	9,000	
	Niigata	S	1,000	
	Hirasawa	S	800	
Tao Nenryo Kogyo Co., Ltd., Tokyo	Shimzu	S-A	5,000	
	Wakayama	S-C	[5]10,000	3,500
Total Japan			85,600	8,500

(1) Includes 3,500 bbl. daily capacity under construction. (2) To be increased to 11,000 bbl. daily. (3) Capacity scheduled for increase to 12,000 bbl. daily in 1953. (4) Operating on topped crude oil. To build topping unit. (5) To be expanded to 13,800 bbl.

KUWAIT

Kuwait Oil Co., Ltd., 1 Great Cumberland Place, London W. 1, England	Mina al Ahmadi	S	25,000	

LEBANON

Iraq Petroleum Co., Ltd., P.O. Box 118, Tripoli	Tripoli	S	10,000	
Mediterranean Refining Co., 551 Fifth Ave., New York 17, U. S. A.	Sidon	[1]		
Total Lebanon			10,000	

1. New 13,000 bbl. daily refinery planned for tentative completion in 1953.

MEXICO

Mexican refining operations were reported in The Oil and Gas Journal's Annual Survey of North American Refineries published March 21, 1951. At time of report the Mexican Government was operating eight refineries having a total capacity of 178,350 bbl. daily crude-oil input and 25,900 bbl. daily cracking.

NETHERLANDS

Company and address—	Refinery location	Type of plant	Crude-oil capacity (bbl. daily)	Cracking capacity (bbl. daily)
Caltex Petroleum Maatschappij, N.V., The Hague	Pernis	S-C	24,000	6,400
N.V. de Bataafsche Petroleum Mij., Carel van Bylandtlaan 30, The Hague	Pernis	Comp.	[1]104,500	[2]53,500
Total Netherlands			128,500	59,900

(1) Includes 4,500 bbl. daily asphalt unit. (2) Includes thermal and catalytic cracking and reforming.

NORWAY

A/S Olandski Petroleum Compagni, 3A Prinsengate, Oslo	Vallo	S-L-A	1,000	

PAKISTAN

Attock Oil Co., Ltd., 24-28 Lombard St., London E. C. 3, England	Rawalpindi	S-C	4,800	2,000

PERU

Cia. de Petroleo Ganso Azul, Ltd., P. O. Box 2560, Lima	Agua	S	700	
Empressa Petrolera Fiscal, Apurimac 224, Edif. Encarnacion 403, Lima	Zorritos	S	1,500	
International Petroleum Co., Ltd., 396 Alhambra Circle, Coral Gables, Fla., U.S.A.	Talara	S-C-L-A	35,800	4,000
Total Peru			38,000	4,000

POLAND

Reliable information on refining operations in this Communist controlled country is not currently available. Estimates indicate six refineries in Poland are operable. Total capacity of these plants is approximately 7,000 bbl. daily.

PHILIPPINES

California Texas Corp.	Batangas, Luzon	Comp.	(1)	

1. California Texas Corp. and affiliated interests plan to build 22,000 bbl. daily complete refinery. Completion tentatively scheduled for 1954.

PORTUGAL

"Sacor" S. A. Concessionaria de Refinacao de Petroleos em Portugal, Rua do Alecrim 57, Lisbon	Lisbon	S-L-A	10,000	(1)

1. Catalytic cracking and other facilities now under construction.

ROMANIA

Information on refining operations in Romania is not currently available through official sources. Estimates based on information through other sources indicate 16 refineries having a total capacity of 200,000 bbl. daily crude-oil input and 50,000 bbl. daily cracking.

SAUDI ARABIA

Arabian American Oil Co., Dhahran	Ras Tanura	S-C	160,000	[1]23,500

1. Catalytic polymerization plant under construction.

SOUTH AFRICA

South Africa Torbanite Mining & Refining Co., Ltd., Box 83, Boksburg North, Transvaal	Boksburg North	S-C	(1)	
Standard-Vacuum Refining Co. of South Africa, Pty., Ltd.	Durban	S-C	(2)	

(1) Shale-oil plant processing 2,000 bbl. of oil daily. (2) Plans call for construction of 15,000 bbl. daily refinery. Facilities to include catalytic cracking.

SPAIN

Cia. Arrendataria del Monoplio de Petroleos, S. A., Torija 9, Madrid	Cornella, Barcelona	S	700	
Refinera de Petroleos de Escomberas, S. A., Carrera de San Jeronimo 19, Madrid	Cartagena	S-C	[1]23,000	[2]8,200
Total Spain			23,700	8,200

(1) Under construction. Completion scheduled for 1952. Current operating capacity, 7,000 bbl. daily. (2) Current expansion program includes reforming and polymerization units, and other facilities.

SWEDEN

A. Johnson & Co., Oljeraffinaderiet, Stureplan 3, Stockholm 7	Nynasham	Comp.	11,000	1,000
	Malmo	S-C	1,800	
Koppartranz Oljeaktiebolag, Box 827, Skarvik, Gothenburg 8	Skarvik	S-C	11,000	(1)
Svenska, Skifferolje Aktiebolaget, Drottninggatanz, Orebro	Orebro	(2)		
Total Sweden			23,800	1,000

(1) Expansion program includes 1,900 bbl. daily thermal cracking unit. (2) Refinery processes shale oil; capacity, 1,900 bbl. daily.

SWITZERLAND

Industrie du Petrole, S. A., Rotkreuz	Rotkreuz	S	4,000	(1)

1. Under construction; 1,000 bbl. daily reforming unit and 2,000 bbl. daily distillation unit.

TURKEY

M.T.A. Enstitusu, Ankara	Batman	S	[1]1,400	

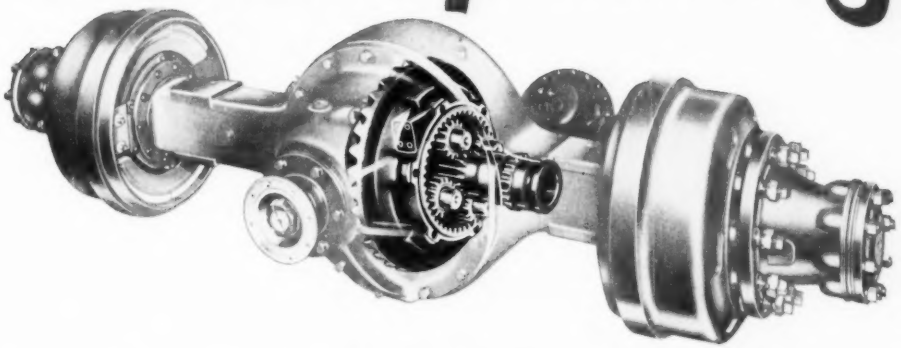
1. Refinery to be increased to 3,500 bbl. daily.

UNITED KINGDOM

England

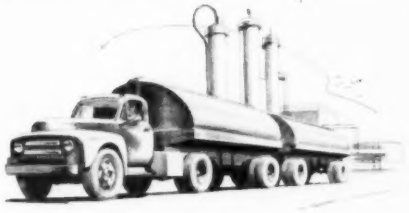
Anglo-Iranian Oil Co., Ltd., Britannic House, Finsbury Circus, London E. C. 2	Isle of Grain, Kent	Comp.	[1]81,000	[1]10,600
Berry, Wiggins & Co., Ltd., Field House Breems Buildings, Fetter Lane, London E. C. 4	Hoo, North Rochester	S	2,000	
	Weaste, Salford	S	1,500	

Planetary Gearing



saves stress & wear— adds to axle life!

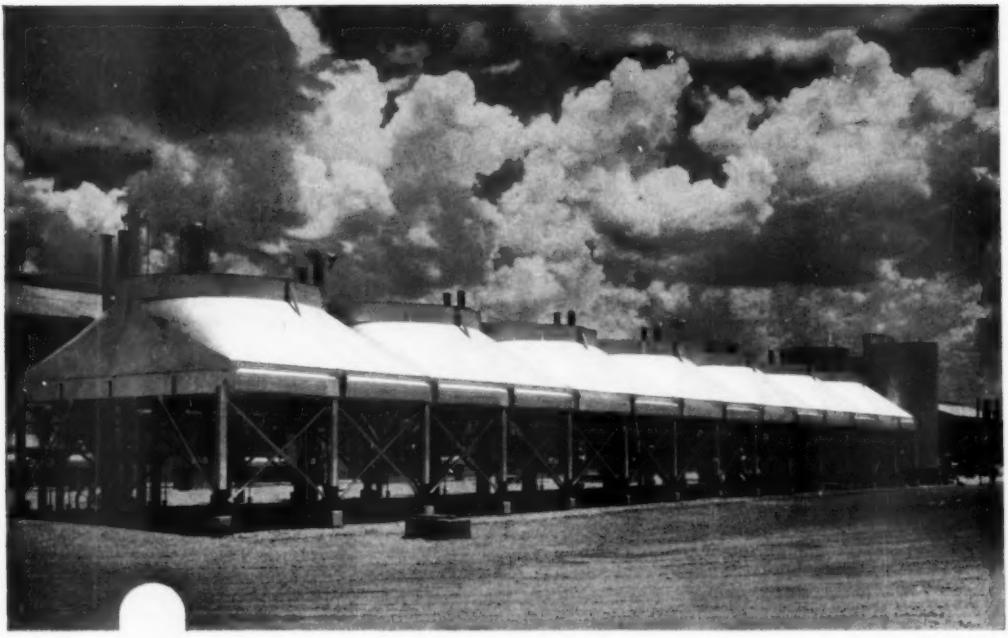
WITH Eaton's planetary construction, gear tooth loads are distributed over four "planet gears," holding stress and wear on any one gear tooth to a minimum. These four gears are completely locked out in the high speed range. In the low speed power range, they rotate at slow speeds. The result is quiet operation; easy, clash-free shifting at all truck speeds; minimum wear; materially longer axle life. The rugged planetary design and forced flow lubricating system—both exclusive Eaton features—enable Eaton 2-Speeds to set unequalled life and performance records. Your truck dealer will explain how Eaton 2-Speeds also reduce stress and wear on the engine and power transmitting parts—how they help your trucks haul more, faster, longer, at lower cost.



Axle Division
EATON MANUFACTURING COMPANY
CLEVELAND, OHIO

EATON
2-Speed Truck
AXLES

PRODUCTS: Sodium Cooled, Poppet, and Free Valves • Tappets • Hydraulic Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Rotor Pumps • Motor Truck Axles • Permanent Mold Gray Iron Castings • Heater-Defroster Units • Snap Rings Springtites • Spring Washers • Cold Drawn Steel • Stampings • Leaf and Coil Springs • Dynamatic Drives, Brakes, Dynamometers



HUDSON SOLO-AIRE EXCHANGERS

Pictured above is an installation of HUDSON SOLO-AIRE JACKET WATER COOLERS providing cool water to the power cylinders, compressor cylinders, and lubricating oil coolers of ten 800 horsepower gas engine driven compressors. The coolers, operating with inlet air temperatures ranging seasonally from below zero to 105°F. deliver cool jacket water at a *uniform, controlled* temperature the year around.

For this installation the great expense of obtaining and treating raw water determined the selection of HUDSON SOLO-AIRE units—rather than HUDSON water cooling tower with HUDSON water-cooled units. The use of air-cooled units in this compressor station precluded the loss through evaporation of about 90 gallons per minute of raw water.

HUDSON SOLO-AIRE units are in use in a great variety of process cooling and condensing services in chemical plants, refineries, and gas processing plants.

OTHER HUDSON "TP" COOLING EQUIPMENT

Bulletins on HUDSON TOP PERFORMANCE COOLING EQUIPMENT mailed upon request

HUDSON
ENGINEERING CORPORATION
FAIRVIEW STATION • HOUSTON, TEXAS

ENGLAND (Continued)

Company and address	Refinery location	Type of plant	Crude-oil capacity (bbl. daily)	Cracking capacity (bbl. daily)
Esso Petroleum Co., Ltd., 36 Queen Anne's Gate, London S. W. 1	Fawley, Southampton	Comp.	[2]115,500	6,000
Imperial Chemical Industries, Ltd., Millbank, London, S. W. 1	Wilton, North Yorkshire	(3)		
Lobitos Oilfields, Ltd., 146 Dashwood House, Old Broad St., London E. C. 2	Ellsmere Port, Cheshire	Comp.	[4]2,200	1,100
Manchester Oil Refinery, Ltd., Twining Road, Trafford Park, Manchester 17	Trafford Park, Manchester	S-C	[4]2,800	
"Shell" Refining & Marketing Co., Ltd., Houndsditch, London E. 1	Heysham, Lanchestershire	S-C	36,000	[5]13,400
"Shell" Refining & Marketing Co., Ltd., and Starhaven Refineries, Ltd., Houndsditch, London E. 1	Shell Haven	Comp.	[7]74,000	[7]10,000
	Stanlow	Comp.	[8]86,800	10,000
Vacuum Oil Co., Ltd., Caxton House, Tothill Sta., London S. W. 1	Coryton, Essex	(1)		
Scotland				
Starhaven Refineries, Ltd., Houndsditch, London E. 1	Ardrossan	(2)		
Scottish Oils, Ltd., 53 Bothwell St., Glasgow C. 2	Grangemouth	S-C	[9]34,000	[7]3,000
	Pumpherston	S-C-W	6,500	7,300
William Briggs & Sons, Ltd., East Camperdown St., Dundee	Dundee	(10)		
Wales				
National Oil Refineries, Ltd., Britannic House, Finsbury Circus, London E. C. 2	Llandarcy	Comp.[11]	[6]60,200	4,000
Total United Kingdom			502,500	59,400

(1) New refinery under construction. (2) Construction under way for increasing capacity to 127,000 bbl. daily. (3) Petrochemical plant. (4) Refinery expansion under way. (5) Facilities to be expanded. (6) Includes 5,100 bbl. daily reforming and 8,300 bbl. daily visbreaking capacities. (7) Includes topped crude and various distillates capacity of 14,000 bbl. daily. (8) Includes topped crude and various distillates capacity of 10,000 bbl. daily. (9) Includes 12,500 bbl. daily capacity topped crude, etc. (10) Topped crude oil. (11) Refinery modernization program under way. (12) Includes 8,600 bbl. of crude oil daily processed in cracking units.

UNITED STATES

The Oil and Gas Journal's Annual Survey of Refineries in North America lists 346 operating refineries in the United States of America. Crude oil capacity of these plants is 7,026,490 bbl. daily; cracking capacity, 2,331,880 bbl. daily. The survey was published in the Journal's Annual Refining Issue, March 29, 1951. The Journal's 1952 U. S. survey will be published March 17, 1952.

U.S.S.R.

Reliable information on current status and capacity of refineries in Russia is not available. Estimates indicate 25 refineries having daily capacities of 750,000 bbl. crude oil and 300,000 bbl. cracking are within the borders of this country.

URUGUAY

Administracion Nacional de Combustibles Alcohol y Portland, Casilla de Correo 1090, Montevideo	La Teja	S	[1]25,200	2,200

1. Includes cracking plant converted to atmospheric distillation. Refinery's normal crude-oil capacity is 15,800 bbl. daily.

VENEZUELA

Colon Development Co., Ltd., Mijares a Mercedes 25, Caracas	La Rivera	S	200	
	El Calvario	S	200	
	Casigua	S	1,500	
Creole Petroleum Corp., Apartado 889, Caracas	Amuay	S	75,000	
	Caripito	S-C	63,000	34,000
Mene Grande Oil Co., Apartado 709, Caracas	Cabimas	S	1,000	
	Oficina	S	300	
Shell Caribbean Petroleum Co., Apartado 809, Caracas	Cardon	S-C	50,000	40,500
	San Lorenzo	S	44,700	
Sinclair Oil & Refining Co., Apartado 1706, Caracas	Puerto la Cruz	S	35,000	
Socony-Vacuum Oil Co., Apartado 246, Caracas	Guario	S	100	
Texas Petroleum Co., Tienda Honda a Punte 59, Caracas	Tucupita	S	10,000	
Venezuelan Gulf Refining Co.	Puerto la Cruz	S	40,000	
Total Venezuela			321,000	74,500

1. Excludes 25,000 bbl. daily heavy crude oil to cracking plants and 7,000 bbl. daily cracking quench oil. Ultimate capacity 115,000 bbl. daily to be in service early in 1953.

WEST INDIES

Aruba

Lago Oil & Transport Co., Ltd., Aruba, Netherlands West Indies	Aruba	S	[1]425,000	[2]353,000
N.V. Arend Petroleum Mij., Willemstad, Oranjestad, N. W. I.	Oranjestad	S	30,000	
Total Aruba			455,000	353,000

(1) Includes 40,000 bbl. daily cat cracking and 263,000 bbl. daily visbreaking. (2) Includes 7,000 bbl. daily to converted cracking unit.

Curacao

N.V. Curacaosche Petroleum Industrie Mij., Carl van Bylandtlaan 30, The Hague	Curacao	Comp.	[1]200,000	[2]118,000

(1) Current intake 345,500 bbl. daily. Involves temporary use of cracking units for crude-oil distillation. (2) Includes 18,000 bbl. daily reforming capacity.

Trinidad

Brighton Terminal, Ltd., 30 Rockefeller Plaza, New York 20, U. S. A.	La Brea	S	5,000	
Trinidad Leaseholds, Ltd., Trinidad House, 29-30 Old Burlington St., London W. 1, England	Pointe-a-Pierre	S	70,000	
United British Oilfields of Trinidad, Ltd., 15 Abercrombay St., Port of Spain	Point Fortin	S	30,000	
Total Trinidad			105,000	
Total West Indies			760,000	471,000

YUGOSLAVIA

Reliable information on refining operations in Yugoslavia are not currently available. Estimates based on latest information from this country indicate five refineries with a total capacity of 8,000 bbl. daily.

YOU GET *GREATER FLEXIBILITY* IN

NEMCO CONTROL STATIONS

"NEMCO" Class 441 Explosion-Proof, Heavy Duty Control Stations offer an unusual degree of flexibility.

They are furnished in five sizes of enclosures to provide for the mounting of from one to five control devices. As a result, the sequence of controls can be varied to suit practically any scheme of operation. Different devices which can be mounted in any one of the unit positions include:

Push-button station; selector switch; pilot light; mushroom cap; emergency break-the-glass station; maintained contact start-stop interlocking pushbutton (requires 2-unit station); etc.

"NEMCO" Heavy Duty Control Stations can be furnished for either surface or flush mounting. Designed for Class 1, Group D Hazardous Locations, they are made from high tensile gray iron which is produced in our own foundry.

WRITE TODAY FOR NEW 10-PAGE BULLETIN No. 441

Size 1 enclosure is for one control unit such as pushbutton, pilot light, selector switch etc. Sizes 2, 3, 4 & 5 also furnished.

Shown above is Size 5 enclosure which will accommodate five different control units. Write for Bulletin No. 441.

NELSON *Electric* MANUFACTURING CO.

217 N. Detroit St. TULSA, OKLAHOMA Telephone 2-5131

SAFETY IS THE BEST POLICY IN LOAD BINDERS

THE CANTON "TAKE-UP" ACTION picks up slack, binds in one operation. Design and heavy duty construction eliminates spread or release while in operation. Each factory tested, guaranteed for specified capacities. 7 sizes from 4,000 to 35,000 lb. rating, priced $3.00 to $14.80. Continuous action makes them a versatile tool in steel, lumber, machinery hauling, logging, oil fields, rigging. Two sizes made without take-up feature.

POPULAR AMERICAN FORGE *RATCHET* LOAD BINDERS

COMPLETE SAFETY IN TIGHTENING, BINDING, RELEASING LOADS . . . versatile "turnbuckle" principle has wide range of application. One man easily operates without aid of extension pipe; no kickbacks, full 8" take-up. 3 sizes, $14.90 to $18.10. Special size ideal for trueing steel work on building construction.

CANTON CAST PRODUCTS CO.

Maker of Concap Exhaust Protectors

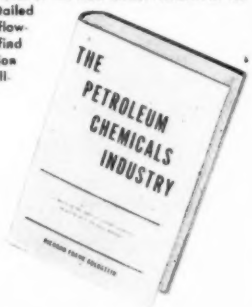
2403 13TH STREET N. E. • CANTON 5, OHIO

"the most useful summary of the petrochemical industry available today."
— The Accelerator.

The Petroleum Chemicals Industry

by RICHARD FRANK GOLDSTEIN

Beginning with the preparation of the desired small hydrocarbon molecules from the petroleum, this valuable book goes on to the reactions of these intermediates to form oxygen, sulfur and nitrogen compounds. One of the most useful features in the book is the many detailed charts or reaction "flow-sheets." Workers will find much of the information they need in these well-prepared charts.



1950
449 pages
$8.50

For sale by

READER SERVICE DEPARTMENT

THE OIL AND GAS JOURNAL

BOX 1260 • TULSA, OKLA.

PROGRESS in METALS

by W. L. Nelson
Consulting Engineer

High-Temperature Properties Of Molybdenum Investigated

THE National Advisory Committee for Aeronautics Technical Note 2319, by R. A. Lang, K. C. Dike, and H. R. Bear, summarizes a series of investigations on the properties of high-purity, sintered wrought molybdenum metal at temperatures up to 2,400° F.

The tensile-strength properties were investigated at temperatures from 1,800° to 2,400° F., as well as the effects of swaging, recrystallization, and "test section" area on these tensile-strength properties. Additional studies were made on stress-rupture properties, types of fracture, directional tensile properties of rolled plate, and metallography of swaged and recrystallized molybdenum.

At temperatures in excess of 1,800° F., commercial pure sintered wrought molybdenum metal had excellent tensile strength, ductility, and stress-rupture life comparable with or superior to other proposed high-temperature materials. At a temperature of 1,800° F., the short-time tensile strength varied between 25,310 and 33,670 psi. At 2,400° F., the tensile strength varied between 13,070 and 26,100 psi., depending upon manufacturing swaging variables and whether the evaluation temperature was above or below the recrystallization temperature of the specimen evaluated.

Recrystallization lowered the tensile strengths of molybdenum at all temperatures. Recrystallized metal had ductility at elevated temperatures, but was brittle at room temperature. The amount of swaging on the particular bar sizes investigated had little effect upon increasing the tensile strength, but increasing amounts of swaging progressively lowered the recrystallization temperature. Increasing the test-section cross-sectional area of a specimen had a negligible effect upon the evaluation of the tensile strength.

Wrought molybdenum had a 100-hour stress-rupture life at approximately 19,300± 300 psi. at 1,800° F. Recrystallized metal had a 100-hour life at approximately 10,000 psi.

As-swaged molybdenum exhibited a transgranular failure under tension at all temperatures until effective recrystallization occurred. Recrystallized molybdenum exhibited intergranular failure at room temperature; from 1,500° to 2,000° F., the fracture was predominantly transgranular; from 200° to 2,400° F., the fracture reverted to the intergranular type.

Rolled molybdenum plate possessed definite directional properties, having the greater tensile strength in the transverse direction to rolling and the greater ductility in the longitudinal direction of rolling.

Stainless Steels Greatly Hardened

A NEW process by which the hardness of stainless steels can be tripled, has recently been announced by Westinghouse Electric Corp.

The new procedure calls for a unique low-temperature treatment in which the steel is immersed in liquid nitrogen baths at —300° F. and rolled or forged at subzero temperatures. Heating at controlled temperatures then further increases the hardness. Hardened stainless steel produced by this process is expected to have wide use as a wear-resistant material in bearings, valve seats, springs, and other machine parts.

Nickel Steels Excel at Low Temperatures

THE resistance of nickel steels to low-temperature embrittlement has been recognized for many years but a direct relationship such as that shown in Fig. 1 has only recently been made available (1950 Data Book, Applications Volume, of the American Society of Refrigeration Engineers, by T. N. Armstrong). All of the steels are in the normalized condition and contain 0.1 per cent carbon except No. 1 (0.2 per cent—a 1020 S.A.E. steel) and No. 2 (0.15 per cent carbon).

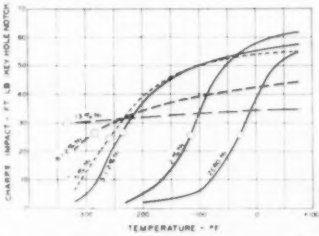


Fig. 1—Effect of nickel content on low temperature embrittlement.

Solid solution alloys generally exhibit good low-temperature shock resistance (such alloys as monel metal, austenitic steels, and pure metals) but no common alloying element except nickel enters into steel as a solid solution with iron and hence most other alloy steels tend to be brittle at low temperatures.

Aluminum Tanks Welded in Field

THE welding of aluminum and its alloys has been difficult because of certain inherent properties of the materials, but by a proper recognition of these properties it is now possible to obtain strong, ductile, high-quality welds. Aluminum has a coefficient of expansion that is almost twice that of steel. This leads to distortion and warpage. The thermal conductivity of aluminum is many times greater than that of iron. This requires more heat input, causes more expansion, and again more warpage. During melting, a heavy skin type of aluminum oxide forms over the welding puddle, and the melting point of the oxide is slightly higher than that of the parent material. This oxide must, of course, be eliminated, fluxed out, or kept from forming. Finally, some of the elements added to aluminum cause hot shortness which tends to cause the formation of cracks while the weld cools.

In spite of these formidable difficulties, the welding of heavy aluminum plate has been satisfactorily accomplished in the construction of dozens of storage tanks and vessels. Nonheat-treatable alloys are the usual plate material but moderate to good results have been obtained with the heat-treatable alloys. The heat-affected zone, however, exhibits a strength intermediate between the strengths of the dead-soft material and the heat-treated material.

The inert gas-shielded arc method of welding is employed, and in the latest development of this method a consumable electrode is fed at a constant rate into the inert arc atmosphere. This allows a much greater speed of welding with less distortion or warpage. However, at the moment, this method does not result in as good weld quality as when a tungsten arc is used. Special welding sequences have been developed to avoid distortion and warpage. The detail of how several large vessels were constructed is disclosed by P. C. Arnold of Chicago Bridge & Iron Co. in "Field Welding of Aluminum Tanks," the Welding Journal, July 1951.

Welding Terms

Bonding Temperature

The temperature to which the surface of the parent metal is heated in order to perform low-temperature welding.

Build STAMINA into your pipe-lines

Reduce maintenance with D-F S-E* *Joints*

Shortages of manpower require you to build stamina in your lines. **Directed-Flexing Self-Equalizing*, an exclusive feature of Badger Expansion joints, assures all-curve flexing in the corrugated member. Thus, localized flexing stresses cannot form . . . metal fatigue cut to a minimum . . . breakdowns are virtually eliminated.

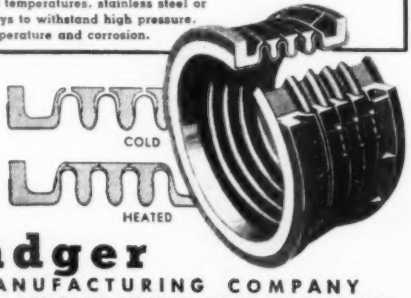
But that's not the whole Badger story. In addition to controlling the flexing movement *within* each corrugation, the specially designed Self-Equalizing Rings also control intra-corrugation movement. For unbeatable stamina be sure you get the exclusive Badger combination — Directed-Flexing Self-Equalizing — when you buy . . . specify Badger Expansion joints for every job.

Only Badger Expansion Joints have Directed-Flexing Self-Equalizing rings which progressively control the movement of the all-curve corrugations.

Plus 5 other big features

- Packless . . . pressure-tight single tube — requires no maintenance
- Compact . . . approximately the size of flanged fitting
- Special forming . . . no structure weakening stresses
- Controlled heat treating . . . assures long life
- Wide range of traverse — pressure — temperature

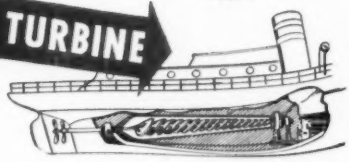
Fabricated from deoxidized copper for normal pressures and temperatures, stainless steel or alloys to withstand high pressure, temperature and corrosion.



Badger
MANUFACTURING COMPANY
230 BENT STREET, CAMBRIDGE, MASS.

FROM AN AXLE

TO A TURBINE



WHEREVER PETROLEUM IS USED AS LUBRICANT OR FUEL

ADSORBENTS

have helped to prepare it!

From plain axle grease to the most highly refined and specialized motor oils—

From the most common commercial grade of fuel to aviation gasoline of the highest rating—

New sense is given to the old saying that "oil and water don't mix."

Wherever decolorization or dehydration enters into petroleum processing, Floridin products have been approved for forty years.

If you have use for natural adsorbents in any industrial process, these products should be of interest to you.

FLOREX FULLERS EARTH

High-pressure extrusion insures maximum effectiveness.

BAUXITE-BASED ADSORBENTS

Write for full data. The advice of a competent technical staff is offered. Your inquiry will get prompt attention.

FLORIDIN COMPANY
Adsorbents . . . Desiccants . . . Diluents

Dept. C, 220 Liberty St., Warren, Pa.

Permeability Distribution and Flood History—3

THE first two parts of this series were discussions of the calculation of flood history resulting from permeability variations throughout a formation. The procedure was based upon a knowledge of the manner in which the flood proceeded in a stratum of uniform permeability. It was shown that the point of first water breakthrough and the increase of water oil ratio could be calculated for any given permeability distribution. The exact flood history depends upon each permeability profile considered and it is of interest to note in this current discussion the range of flood history—for different permeability profiles.

For example, if the permeability of the formation is uniform the water-oil ratio is zero until all oil is produced and immediately thereafter it goes to infinity (the condition of planar flood advance is an assumption of the method, as previously discussed). If the permeability distribution of the bed is such that a zone of negligible pore space but relatively high permeability capacity exists, the water-oil ratio immediately goes to an infinitely high value when little oil production has been realized. If a formation has a distribution of permeabilities but no high or low extremes, the recovered oil is relatively high at first water breakthrough and the tailoff period is narrow. If a formation has a distribution with both high and low extremes of permeability, the breakthrough of water is early and the tailoff long. Referring to Fig. 1, therefore, a plot of water-oil ratio versus cumulative oil could follow any type variation, as indicated, depending upon the types of permeability variations which exist.

Fig. 2 shows two different actual permeability distributions taken from core data.[1,2] Fig. 3 shows the calculated performance using these permeability distributions and a mobility ratio of one. The less uniform distribution has a greater tailoff of production.

Fig. 4 shows the curves of Fig. 3 plotted on semilog paper. These plots are linear for a fair portion of their total range. This indicates that it would be erroneous to ascribe such variations in actual production history to changes in relative permeability with fluid saturation as is sometimes done.

More extensive calculations have been made and reported in the literature to show the variation of flood performance with permeability distribution.[3,4] Fig. 5 is a duplicate from one of these sources to show the wide variation of flood performance which can be ascribed to simple types of permeability variations.

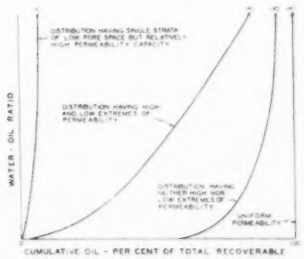


Fig. 1.

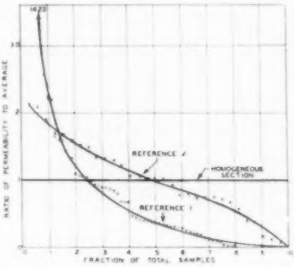


Fig. 2—Permeability ratio in decreasing order plotted vs. cumulative fraction of samples.

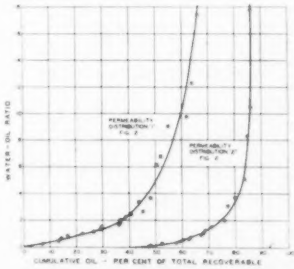


Fig. 3.

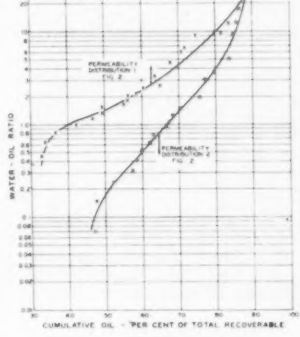


Fig. 4.

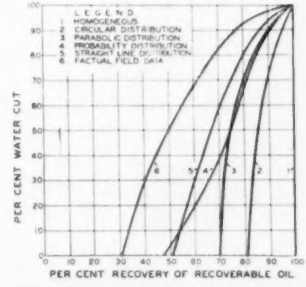


Fig. 5—Variation in flood history for simple permeability distributions. (This is Fig. 3 from Reference 4.)

References

1. Folger, Frank, M.S. thesis, University of Oklahoma, 1949, Table 7.
2. U.S.B.M. R.I. 3715, p. 84.
3. Dykstra and Parsons, Oil-Recovery Prediction by Water Flood, Secondary Recovery of Oil in U. S., 2nd Edition, A.P.I., 1950.
4. Schmalz and Rahme, The Variation in Water-Flood Performance With Variation in Permeability Profile, Producers Monthly, Vol. 14, No. 9, July 1950.

Series by John C. Calhoun, Jr., Chairman, Petroleum Engineering School, Penn State College

WINDOW ON THE FUTURE

A great new oil refinery with a projected capacity of 30,000,000 barrels a year is being erected by Anglo-Iranian on the coast of Kent, at a cost of some $112,000,000.

Their three existing refineries in the United Kingdom already have a combined annual capacity of over 44,000,000 barrels.

In many other countries the refineries operated by Anglo-Iranian and its associated companies are increasingly contributing to the world's supply of petroleum products.

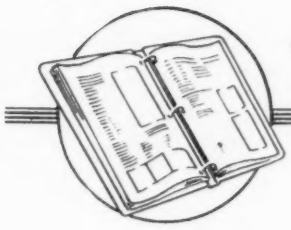
BP

THE BP SHIELD IS THE SYMBOL OF THE WORLD-WIDE ORGANISATION OF ANGLO-IRANIAN OIL COMPANY, LTD.

Anglo-Iranian Oil Company

LIMITED

REPRESENTATIVE IN U.S.A.: W.D. HEATH EVES, 610 FIFTH AVENUE, NEW YORK 20, N.Y.



THE REFINER'S notebook

No. 102

Steam-Turbine Controls

by J. A. Pellettere*

A CONTROL problem associated with the use of steam turbines in the refinery to drive pumps and compressors is that of obtaining good regulation at varying speeds as well as at varying loads.

Oil was required for bearing lubrication and cooling, so it was only a short step to make use of the oil pumping system to hydraulically govern the turbine. But industry today is using pneumatic systems to the best possible advantage in the field of controls and it should be possible to inter-tie properly the pneumatic with the various hydraulic systems of turbine governors.

Terminology.—When the various turbine governor specifications are compared, it will be noted that certain words and phrases such as *relay, hydraulic constant speed type, variable speed type, regulation* and many others apper to be used with meanings that are different for the manufacturer and for the user. Consequently, each has his own version of the requirements. This results quite often in a poor performance unit, especially when an instrument control, and the turbine manufacturer is unable to aid in solving the problem due to his lack of understanding of the user's desires or needs. (See Table 1.)

Relay.—Just what is meant by the word *relay*? Any dictionary will define it as a device by means of which feeble forces can regulate forces of greater magnitudes. With this definition in mind, it can be stated that the average hydraulic governor can contain two relays: one usually operates in conjunction with a primary element such as the flyball; the second usually is a part of the mechanism for positioning the steam valve. Although an internally balanced steam valve could be called a relay, conceivably, since it too conforms in part with the definition, it will not be considered as such here.

Other terms. — *Constant - speed governor* and *variable-speed governor* are self-explanatory only insofar as the general description is concerned. There can be numerous classes of governors that will fall into one or the other of these two types, but neither type is exclusively *hydraulic*.

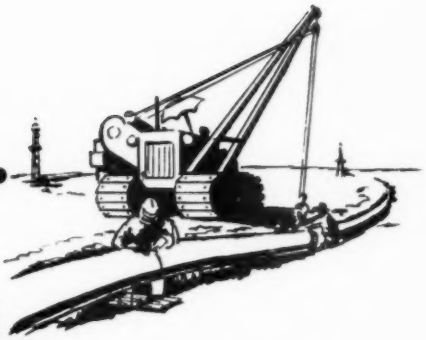
What is meant by the term *hydraulic governor*? When compared with the simple shaft or mechanical governor, the differences are obvious. But consider a so-called hydraulic governor with its necessary flyball, relays, and servomotor. Assume that the governor is equipped with a diaphragm motor so as to control from a pneumatic instrument, and that, when on instrument control, the flyball and hydraulic components are retired to standby service. When a pneumatic impulse is used and a diaphragm motor acts to position the steam valve directly through mechanical linkage, can this governor still be called *hydraulic*?

*Gulf Oil Corp. Portion of paper presented at 1951 I.S.A. meeting, Houston.

TABLE 1—TURBINE GOVERNOR TERMINOLOGY

TERMS	INSTRUMENT ENGR.	STEAM ENGR. OR USER	MANUFACTURER
Regulation	Control band sensitivity throttling range	Per cent fall off in speed due to loading. Speed gradient or droop	Per cent rise in speed (on a gradual change) from full load to no load. (Usually 2 to 8 per cent)
Turn-down		Variable speed operation	Ratio of rated normal speed to minimum speed required
Hydraulic	Hydraulic power	Oil power operated steam valve	Requires hydraulic unit and in some cases also steam balanced or powered single seated steam valve
Relay	Operator of hydraulic Servomotor	Part of hydraulic unit	Anything that squirts oil except to bearings
Isochronous	Proportional plus reset type	Constant speed under all loads	Equipped with regulation eliminator to give zero regulation
	Derivative action		Will not discuss as such but may build such into his basic design
	Reset rate adjuster		Stability adjuster on Isochronous type only
Constant speed	Might expect proportional reset type	Low speed gradient with one operating load or constant duty	Would normally build in flyball unit if manual turn-down ratio asked for is not excessive, or use flyball unit as pre-emergency when operated by pneumatic impulse
Variable speed medium regulation (8%)	Wide turn-down with wide (8%) throttling range or proportional band	Wide speed range for varying load duty, with fair regulation	Flyball type can be replaced by orifice type if regulation asked for is not 4 per cent or less in order to reduce cost
Variable speed with close regulation (4% or better)	Wide turn-down with narrow proportional band	Wide speed range, varying load operation, close regulation important	Requires wide range flyball type unit continuously operated by manual speed changer and/or pneumatic impulse

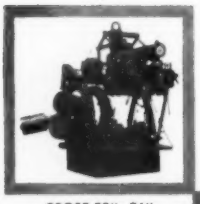
IN LAYING PIPE...



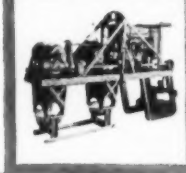
look to CROSE

Through coordinated experience, Crose offers sound recommendations and facilities so necessary in these days of competitive challenge. Profound improvement in pipe line work calls for "know how" and "know why" which Crose contributes freely . . . with no gimmicks, no guesswork. Any time is the best time to look to Crose for the best in both equipment, materials and supplies.

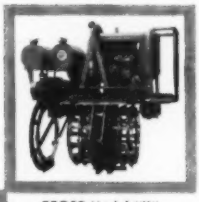
For detailed information, *write for descriptive pipe line equipment Catalog No. 950.*



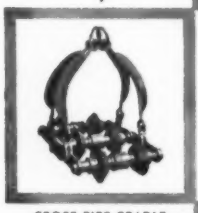
CROSE 22" - 26" Line-Traveling COATING and WRAPPING MACHINE



CROSE Auger-Type ROAD BORING MACHINE

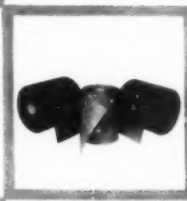


CROSE Model "K" PIPE CLEANING and PRIMING MACHINE



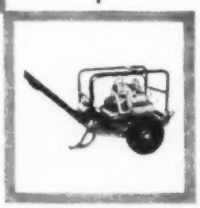
CROSE PIPE CRADLE

CROSE ENDLESS PIPE BELT SLING



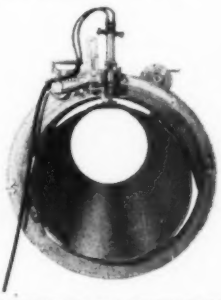
PIPE WRAPPING MATERIALS—
Vitron Glass Fiber
Asbestos Felt
Kraft Paper
Rock Shield

CROSE INTERNAL LINEUP CLAMP



CROSE 1500 WATT SELF-PROPELLED GENERATOR

CROSE-LITTLEFORD 23 BARREL PIPE COATING KETTLE
These kettles are also available in both 10 and 30 barrel capacity. Patch kettles are also available.



CROSE PIPE CUTTING and BEVELING MACHINE

M. J. CROSE **MANUFACTURING CO., INC.**
MAIN OFFICE: 2715 DAWSON RD., TULSA, OKLA.
BRANCH OFFICE: M&M BUILDING, HOUSTON, TEX.
EXPORT SALES: 500 FIFTH AVE., NEW YORK, N. Y.

PIPE LINES

Gains Scored

Third-quarter tab shows revenue, traffic increases

WASHINGTON.—Increases of nearly 10 per cent in volume and 12.6 per cent in transportation revenue were recorded by the 52 largest oil-pipe-line companies in the third quarter this year as compared with 1950.

Reports to the Interstate Commerce Commission by companies having annual operating revenues of more than $500,000 showed that a total of 792,552,009 bbl. of oil were originated on line and received from connections during the quarter as compared with 724,209,256 bbl. in the same 1950 period.

Transportation revenue was $121,521,714 compared with $107,945,191, but 16 of the 52 companies reported that revenues were less this year than last.

Traffic.—The heaviest traffic was reported by the Humble Pipe Line Co., 77,524,731 bbl. against 66,395,977 bbl. in the third quarter of 1950, followed by Texas Pipe Line Co., 51,710,051 bbl. against 48,655,073 bbl.; Gulf Refining Co., 49,313,075 bbl. against 41,414,340; Interstate Oil Pipe Line Co., 44,444,685 bbl. against 44,334,293 bbl.; Service Pipe Line Co., 44,027,256 bbl. against 41,221,489 bbl.; Magnolia Pipe Line Co., 43,603,205 bbl. against 46,805,544 bbl.; Buckeye Pipe Line Co., 43,119,164 bbl. against 41,121,155 bbl.; Sinclair Pipe Line Co., 41,479,030 bbl. against 35,760,611 bbl.; Shell Pipe Line Corp., 35,585,687 bbl. against 31,718,446 bbl., and Ohio Oil Co., 35,350,792 bbl. against 35,035,735 bbl.

Revenue.—Leading the field in total transportation revenue was Service with $14,105,238 against $12,772,470 for a gain of 10.4 per cent. Following in order were Humble, $11,095,230 against $8,925,186, increase of 24.3 per cent; Sinclair, $9,082,063 against $8,093,318, increase of 12.2 per cent; Magnolia, $8,153.797 against $8,248,641, for 1.2 per cent decrease; Gulf Refining, $7,637,996 against $7,140,558, for 7 per cent increase; and Texas Pipe Line, $7,596,546 against $6,668,928, for 13.9 per cent increase.

FCC O.K.'s New Facilities In Petroleum-Radio Service

WASHINGTON.—Construction permits for 42 base stations, 60 mobile units, 2 operational fixed-control stations, and 18 relay stations in the petroleum-radio service have been granted by the Federal Communications Commission as follows:

Michigan-Wisconsin Pipe Line Co., 2 FST-140 base stations near Rodney and Detroit, Mich., to operate on a frequency of 48.90 mc., 2 FTR-10-C operational fixed-control stations at Detroit, and 18 FTR-10-C fixed-relay stations, 3 each near Corunna, Perrinton, Remus, Rodney, Cedar Springs, and at Grand Rapids, Mich. Operation on frequencies of 1,860 and 1,980 mc.

Service Pipe Line Co., 6 CT-10-A base stations near LaRose, Laura, Galesburg, and Niota, Ill., and Carrollton and Kirksville, Mo., and 10 CTR-2-A base stations near Hammond and Griffith, Ind.; Freeman, Independence, La Plata, Center, and Silex, Mo.; Wood River, Ill.; Center, Okla., and Lovington, N. M., all on 49.14 mc.

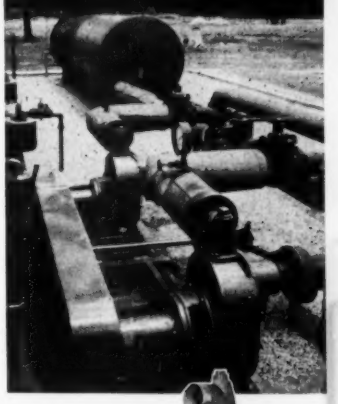
Northern Natural Gas Co., one FSTR-140-BR (BW) 1-A base station on 33.18 mc. at Hugoton, Kans.

Gulf Research & Development Co., 9 additional 2365-M and 9 BC-375-E (mod.) mobile units on 25.02, 25.06, 25.10, 25.14, 25.18, 30.66, 30.70, 30.74, 30.78, and 30.82 mc.

Interstate Oil Pipe Line Co., 15 additional

DECADE OF PIPE LINING.—Herman E. Talmadge, governor of Georgia, and Charles R. Younts, president of Plantation Pipe Line Co., collaborate in cake-cutting ceremonies marking Plantation's tenth birthday. The anniversary was observed at Bremen, Ga., December 4 coincidentally with dedication ceremonies for the company's new 700-mile products main between Baton Rouge and Charlotte, N. C.

NO TROUBLE PERMITTED HERE



...so MARLOW PUMPS are put to work.

Efficient, trouble-free pumps MUST be used on the important oil country service of circulating hot water for an indirect emulsion heater. Temperatures of the treating tank must be kept uniform by a constant hot water flow. That's where Marlows come in.

The two Marlow Model 34EB Self-Priming Centrifugal pumps above are used by Continental Oil Company at Ville Platte, Louisiana, to handle this critical operation. It is one of four such crude oil emulsion heater systems on Continental leases in the Ville Platte area — AND MARLOW PUMPS ARE USED ON THEM ALL.

Marlow Pumps are ideal for many oil country jobs. Write for complete information.

MARLOW PUMPS
544 GREENWOOD AVENUE
RIDGEWOOD, NEW JERSEY
Engineers and Representatives Everywhere

PERRAULT

★ PIPE COATING AND WRAPPING MACHINES LINE TRAVELING AND STATIONARY

★ PIPE CLEANING AND PRIMING MACHINES

★ TAR HEATING KETTLES

★ BENDING MACHINES

★ PIPE CRADLES

★ PIPELINE SUPPLIES

"EVERYTHING FOR THE PIPELINER"

PERRAULT Brothers, Inc.
1130 NO. BOSTON,
TULSA, OKLA. • 5-1103

Export Office:
30 ROCKEFELLER PLAZA
NEW YORK, N. Y.
CIRCLE 6-6260

INFERNO Gas Burners

Built to "Take It"

Hard-firing, long lasting INFERNO medium pressure (10 to 20 lbs.) gas burners are built to "take it"—designed to stand up under rugged oil field conditions and continuous usage. Burner heads made of special heat-resisting metal that will last four or five times longer than cast iron. They have a tensile strength of more than 50,000 pounds a square inch. Manifold made of 2" heavy black pipe, welded at all connections. Orifice plugs made of brass. Burner heads have flat tops, easily kept clean. Pilot burner guards against fire going out when set low, makes lighting burners safe and easy. Write for Bulletin 13-D.

The INFERNO CO.
Box 1138A
115 RICOU St.
SHREVEPORT, LA.

mobile units on 158.31 mc. in Oklahoma, 2 FMTRU-5V, 2 FHTRU-1B, 7 FMTRU-140-D, 1 ES-13-A, 3 1100-A.

Pennsylvania Gas Co., 1 FMTR-41B base station at Erie, Pa., 10 mobile units, 5 FMTR-41V and 5 FHTR-1(D), in Forest and Warren counties, Pennsylvania, on 48.78 mc.

Sun Oil Co., 2 PTL-96-A base stations at temporary locations in the continental United States and 6 PTL-46-X mobile units on 2,292 kc.

Sun Pipe Line Co., 4 base stations to operate on 49.62 mc. near Dunn and Gay Hill, Tex., and temporary locations in Texas, Louisiana, Arkansas, and Mississippi.

Pan American Southern Corp., 5 additional mobile units on the frequency of 33.22 mc. in Columbia, Ouachita, and Union counties, Arkansas.

Wright, Clark & Senkel, Inc., 1 base station to operate on 48.70 mc. at temporary locations in North Central Texas.

The Texas Co., 1 base station at Port Arthur, Tex., and 15 mobile units in Jefferson County, Texas, on 153.11 mc.

Texas Pipe Line Co., 2 base stations, near Houma and Cocodrie, La., and 11 base stations near Cocodrie, all on 153.29 mc.

Virginia Gas Transmission Corp., 1 base station to operate on 33.38 mc. at Falls Church, Va.

Oklahoma Natural Expands System With Two New Lines

Oklahoma Natural Gas Co. has awarded contract to Trojan Construction Co., Oklahoma City, for construction of 23 miles of 24-in. natural-gas line from Oklahoma Natural's Depew, Okla., underground-storage field to its Kellyville, Okla., compressor station.

Joseph Bowes, company president, said the line will increase gas deliveries to the Tulsa, Muskogee, and Okmulgee, Okla., areas.

Trojan also was awarded contract for 14 miles of 8-in. gas line from Shamrock to Cushing, Okla. This line will augment gas supplies in the Cushing, Stillwater, Pawnee, Okla., areas, adding a second source of supply to the existing line from Guthrie.

Bowes said total cost of the two projects would exceed $1,500,000.

Dispute Causes Change in Plans for California Line

LOS ANGELES.—Plans for the construction of a pipe line between Santa Fe Springs, Calif., and the Arizona border have been revised by Southern California Gas Co. and Southern Counties Gas Co.

The companies said that a disagreement with the Interior Department over conditions for laying the pipe caused them to change plans. As originally planned the line would have extended 87 miles and carried 150,000,000 cu. ft. of gas daily. The new plans call for building a 45-mile line with enough additional compressor capacity to transport the same amount of gas.

A new application covering the project has been filed with the Federal Power Commission. The new plan is reported to be considerably cheaper.

IN STOCK AT Wood's
DALLAS
WAREHOUSE

SHEAVES • PULLEYS • HANGERS • PILLOW BLOCKS (Plain, Babbitted and Ball Bearing) • COUPLINGS (Flexible, Flanged and Compression Types) COLLARS • "SURE-GRIP" SHEAVES AND PULLEYS • "SURE-GRIP" INDUSTRIAL V-BELT • "SURE-GRIP" FHP SHEAVES AND V-BELTS • COMPLETE DRIVES.
Write for detailed information.

T. B. WOOD'S SONS COMPANY
1117 W. COMMERCE ST., DALLAS, TEXAS
Main Office & Factory: Chambersburg, Pa.
Branches: Boston, Mass., Newark, N.J., Cleveland, O.

SAFEGUARD YOUR ENGINE
Industrial
Electric Tachometer's
(R.P.M. Indicator)

Complete in one unit. Quick and easy installation. Checks correct operating speed. For all internal combustion engines.

Write For Detailed Information

WAIT MFG. CO.
P. O. BOX 1015 TULSA, OKLA.

EXCEL-SO
CALIBRATING TANKS
for displacement meters.
Any capacity — Any Specification.
Write For Bulletin

WARNER LEWIS COMPANY
P. O. BOX 3096-A • TULSA, OKLA.

STOP CORROSION BEFORE IT STARTS

Asbestos Pipe Line Felt is time tested and proven on the line. WHY EXPERIMENT?

Asbestos Pipe Line Felt has been used to protect underground pipe coatings for more than a quarter of a century. The coatings on thousands of miles of lines are protected by Asbestos Felt. Most major pipe line companies have personal experience as to its effectiveness.

NICOLET Asbestos Pipe Line Felt is not a thin foreign product in the enamel, but a rugged 15-lb. inorganic shield which protects the enamel insulation on the outside—where corrosion starts. NICOLET Felt is saturated with the same basic bitumens as the coating.

NICOLET Asbestos Pipe Line Felt can be made to your particular specifications.

WRITE FOR LITERATURE AND PRICES

NICOLET* ASBESTOS PIPE LINE FELT

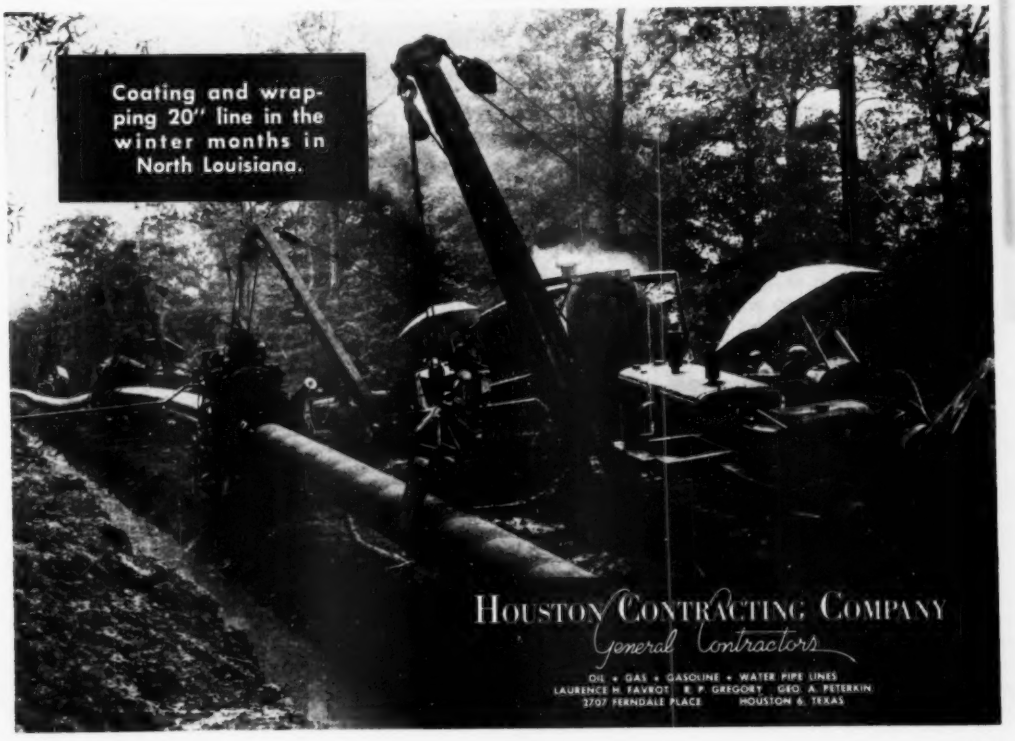
"the felt with a future"

*FORMERLY GAMA

The Felt With a Future

MANUFACTURED BY:
NICOLET INDUSTRIES, INC.
FORMERLY GAMA INDUSTRIES, INC.
70 Pine Street New York 5, N. Y.

DISTRIBUTED BY:
MIDDLE WEST COATING & SUPPLY*
207-A Daniel Bldg. Tulsa, Okla. Ph. 2-5215
P. O. Box 153 or 2-5216


Coating and wrapping 20" line in the winter months in North Louisiana.
HOUSTON CONTRACTING COMPANY
General Contractors
OIL • GAS • GASOLINE • WATER PIPE LINES
LAURENCE H. FAVROT R. P. GREGORY GEO. A. PETERKIN
2707 FERNDALE PLACE HOUSTON 6, TEXAS

Factory Processed

NEW-GUARANTEED 6 X 6'S

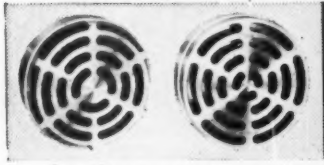
The best of Army surplus stocks . . . completely processed . . . ready for your heavy equipment requirements. Available from 5 to 25 ton . . . GMC 6x6, NM MACK, NO MACK, INTERNATIONAL, DIAMOND-T, WHITE DIESEL, HALF-TRACK.

Write for our latest complete Military Parts Catalog

ZELIGSON
TRUCK and EQUIPMENT COMPANY
6707 E. ADMIRAL PLACE TULSA, OKLAHOMA

Compressor Efficiency

has no equal in the race for greater output



VOSS VALVES have no equal

for they assure maximum compressor efficiency

It is a matter of record that every time an ordinary compressor valve is replaced with a specially designed VOSS valve, the immediate result is increased efficiency and greater output . . . and this record covers thousands of installations, as letters and reports testify.

VOSS VALVES and PLATES are NOT STAMPED; they are hogged, milled and machined for perfect fit; of finest heat treated alloyed steels; they are ductile; resist fracture, high temperatures and corrosion; withstand fatigue; won't work-harden, chip, splinter, crack or score cylinder walls.

INCREASE EFFICIENCY AND OBTAIN GREATER OUTPUT . . . send us the name, bore, stroke and speed of your compressors. Our detailed proposal will be sent without obligation.

VOSS VALVES and PLATES ASSURE

- Quiet, vibration-free operation
- 20 to 60% more valve area
- Less power consumption
- Low pressure loss
- Normal discharge temperature
- Lower operating costs
- 35% more work

J. H. H. VOSS VALVES
REG. U.S. PAT. OFF.

J. H. H. VOSS CO.
INCORPORATED

786 East 144th Street, New York 54, N. Y.

Lone Star Agrees to Buy Former United Properties

DALLAS.—Lone Star Gas Co. has entered into an agreement to buy the former Wichita Falls division of United Gas System for about $5,500,000.

Properties consist of a pipe-line system running from East Panhandle field of Texas south to Wichita Falls and from Young County to Wichita Falls. The system would be acquired from Martin Wunderlich, Omaha, and Lee Aiken, Corpus Christi, who contracted to buy the properties from United Gas System last summer.

They are now in the process of obtaining necessary authorization of certain of the facilities subject to the Federal Power Commission's jurisdiction. Lone Star also has agreed to furnish additional gas for operation of the system pending completion of the sale to the company.

Gulf Refining Co. Building 88-Mile Oil Line to Mobile

MOBILE. — Gulf Refining Co. is building an 88-mile, 14-in. oil pipe line from the Lumberton loading station to this city. It will have eight heater stations and one pump station along the route.

Oil will be fed into the line by gathing lines from Eucutta, Heidelberg, and Baxterville fields of Mississippi.

Heretofore the gathering lines have fed into storage tanks at the loading station, and oil was then transported by tank car to a New Orleans terminal at the rate of about 80 to 130 tank cars daily.

Texas-Empire Plans Crude System Expansion in Illinois

HOUSTON. — Texas - Empire Pipe Line Co. plans to modernize and expand its crude-oil pipe-line system from Wilmington, Ill., to Lockport, Ill., beginning next year.

R. B. McLaughlin, chairman of the board, said approval has been obtained from the Petroleum Administration for Defense, and it is anticipated that pipe will be received and actual construction undertaken in August 1952.

The company plans to award a contract for construction of about 30 miles of 18-in. line between Wilmington and Lockport.

Pipe-Line Brief

Texas Exploration Co. has recently completed a 42-mile, 8-in. crude-oil line from Wizard Lake pool in Alberta to Edmonton, according to R. B. McLaughlin, president of Texas Pipe Line Co. The new line will deliver to the McColl-Frontenac Oil Co., Ltd., refinery at Edmonton and to Interprovincial Pipe Line Co. system.

PUMPS

CENTRIFUGAL
RECIPROCATING

BUILDERS OF OUTSTANDING PUMPS
Since 1869

ESTABLISHED 1869

DEAN BROTHERS PUMPS INC.

INDIANAPOLIS IND.

323 W. TENTH ST.

RAMSCO

FREE TURNING

BALL BEARING SWIVEL FITTINGS

FOR LIQUIDS, GASES, STEAM, AND OTHER CHEMICALS. HOT OR COLD SERVICE. CONTINUOUS OR OCCASIONAL ROTATION SERVICE.

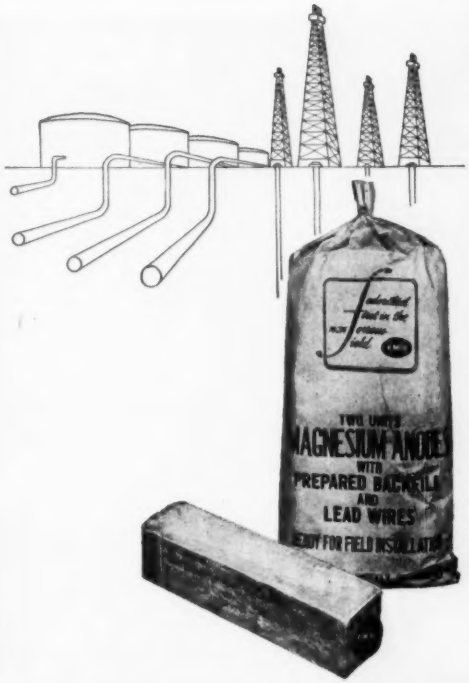
360° FREE ROTATION—1, 2 AND 3 PLANES

Your particular piping problems solved. You name it—we have it. Over 500 sizes, types, styles. Sizes: ⅜" to 14" low pressure; ⅜" to 6" high pressure. Corrosive service or steam fittings 1000 psi. and temp. to 750°F., asbestos or Teflon packed. Low pressure fitting to 1000 psi. and temp. to 225° F. High pressure fittings to 15,000 psi. and temp. to 225° F. Gear driven types available.

Send for complete catalog and prices. State kind of service, pressure, temperature, pipe size and indicate style at left, threaded, flanged or weld ends.

RASMUSSEN MFG. CO.
12305 INDUSTRIAL AVENUE
HOLLYDALE, CALIFORNIA

RAMSCO



FIGHT UNDERGROUND CORROSION with FEDERATED MAGNESIUM ANODES

Corrosive attacks on storage tanks, pipelines and other buried metal structures can in most cases be controlled easily and inexpensively by using Federated Magnesium Anodes. The time and money involved in finding and repairing damages so caused can therefore be saved.

Federated Magnesium Anodes have several unique features. Each has a spirally wound electro-galvanized strip core completely bonded to the magnesium alloy to assure perfect electrical contact between the metal of the anode and the metal to be protected. This means you get *better* protection *longer*. The core extends the full length of the anode, too, assuring long anode life. All connecting wire joints are silver-soldered for low resistance and high strength.

Federated Magnesium Anodes are available in all standard sizes . . . a variety of special sizes can be had at little or no extra cost. Federated engineers will gladly give technical service on your installation problems.

To assist further those engaged in cathodic protection of pipelines, Federated has developed a Magnesium Anode Cathodic Protection Guide in convenient slide rule form. With this you can determine anode current output, length of pipe protected, required anode weight, and anode life when soil resistivity and pipe diameter are known. Write Dept. SR now on your company letterhead for your copy.

Federated Metals Division

AMERICAN SMELTING AND REFINING COMPANY • 120 BROADWAY, NEW YORK 5, N.Y.

...They're consumed in our exclusive TANDEM COMBUSTION UNITS

NATIONAL AIROIL oil-gas Tandem Combustion Units for up-firing of petroleum heaters are now available with an additional "safety insurance" feature . . . and this same safety feature is easily adaptable to your present NATIONAL AIROIL Tandem Units.

Fuel gas passing through the venturi tube causes a "suction" which draws the heavier-than-air gas fumes into the burner. Consequently, dangerous gas accumulations are prevented by the normal burning process of the NATIONAL AIROIL Tandem Unit.

For vertical or horizontal firing, NATIONAL AIROIL oil-gas Tandem Combustion Units are widely popular throughout the U. S. and other countries.

Ask for details upon your business letterhead.

OIL BURNERS and GAS BURNERS for industrial power, process and heating purposes: STEAM ATOMIZING OIL BURNERS; MOTOR-DRIVEN ROTARY OIL BURNERS; MECHANICAL PRESSURE ATOMIZING OIL BURNERS; LOW AIR PRESSURE OIL BURNERS; GAS BURNERS; COMBINATION GAS and OIL BURNERS; AUTOMATIC OIL BURNERS, for small process furnaces and heating plants; FUEL OIL HEATERS; FUEL OIL PUMPING and HEATING UNITS; FURNACE RELIEF DOORS; AIR INTAKE DOORS; OBSERVATION PORTS; SPECIAL REFRACTORY SHAPES.

CHEMICAL-PETROLEUM DIVISION

NATIONAL AIROIL BURNER CO., INC.

Main Office & Factory: 1236 EAST SEDGLEY AVENUE, PHILADELPHIA 34, PA.
Southwestern Division: 2512 South Boulevard, Houston 6, Texas
INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT

NATURAL GAS

Production Swap

Firms agree to 20-year, $100,000,000 gas trade

SHREVEPORT.—Humble Oil & Refining Co. and Southern Production Co. have entered into a 20-year, $100,000,000 agreement for exchange of natural gas from Texas and Louisiana fields.

Under the precedent-setting pact, Humble will deliver 75,000,000 cu. ft. of gas per day from its Duck Lake and Lake Sand fields in Louisiana to Southern Production. The latter in turn will deliver a like amount to Humble from Pledger field in Brazoria and Matagorda counties in Texas. The deal will provide each company with more convenient outlets for gas production from its fields at locations nearer existing pipe-line facilities.

Another unusual feature of the trade is that it calls for an exchange of gas aboveground. Negotiations originally were carried on with a view toward exchange of gas in place. The U. S. Treasury effectively squelched the idea by ruling that this type of agreement would constitute a taxable exchange. The present agreement is subject to a Treasury ruling that the aboveground swap is nontaxable.

More than 700 billion cubic feet of gas, valued at $100,000,000 at estimated present field prices in Texas and Louisiana, is involved in the agreement.

Effects.—It is reported that a substantial gas reserve owned by Humble in Texas will be freed for use within the state, thereby avoiding the possibility that the company might be declared subject to Federal Power Commission regulation as a natural-gas company if it continues to move the gas in interstate commerce.

Another effect is that Humble will obtain almost complete control of Pledger field gas. The company now has 44 per cent while Southern Production has 48 per cent.

Southern Natural Gas Co. will be affected indirectly by the agreement. The company will purchase Pledger field gas over a 20-year period, subject to Office of Price Stabilization approval as to purchase price. This will hold true as long as OPS holds jurisdiction, but prices will thereafter be fixed at prevailing rates in the area.

Sulfur Plant Progressing

ODESSA, Tex.—The new sulfur-extraction plant of Phillips Chemical Co. under construction in the Goldsmith oil and gas field near here will be placed in operation about February 1, 1952, according to Phillips officials.

The plant represents an investment of $1,741,000. It is designed to extract 145 long tons of sulfur per day from natural gas.

Production will be shipped by rail to California.

$11,400,000 Rate Increase Recommended for Tennessee

WASHINGTON.—An $11,400,000 annual boost in rates of Tennessee Gas Transmission Co., Houston, has been accepted by Federal Power Commission members, all intervenors, and Tennessee itself as being reasonable.

The $11,400,000 figure was reached in settlement of a rate-suspension proceeding in which the company was seeking an $18,000,000 per year increase.

New rate schedules providing for this increase would be filed by January 11 and would remain in effect until accepted or amended by FPC order following a determination of the proper distribution of the increase. Further hearings on distribution of the rate boost among Tennessee's rate zones are scheduled to be held before January 8.

The FPC staff, in computing the $11,400,000 figure, allowed several adjustments in the company's cost of service, including increases in purchased gas cost due to the Texas gathering tax and the operation of escalator clauses in gas-purchase contracts. The latter increase amounted to $2,359,809. An Office of Price Stabilization official said the increase in field price was sanctioned by present regulations.

Affected by the suspended rate schedules is service in Louisiana, Mississippi, Tennessee, Kentucky, West Virginia, Ohio, Pennsylvania, and New York. Rates were suspended by the commission last July.

FPC Releases Statistics on Gas Firms' 1950 Operations

WASHINGTON.—"Statistics of Natural Gas Companies," reporting 1950 operations and status at the end of the year of 135 natural-gas companies, has been released by the Federal Power Commission.

For 116 individual companies in classes A and B, the publication contains detailed financial and operating information in the form of statements of the balance sheet, income and earned-surplus accounts, gas operating revenues, customers, sales, capital stock and long-term debt, gas operating expenses, gas utility plant investment, gas account, and data on physical property. Similar data, except that on capital stock and long-term debt, are shown in condensed form for 19 companies in classes C and D.

Companies in classes A and B are those having annual gas operating revenues in excess of $250,000, while those companies in classes C and D report revenues of more than $25,000 but less than $250,000.

Comparative financial statements summarizing the data of all companies are shown for the years 1940 through 1950.

Copies of the publication may be obtained from the Publication Section, Federal Power Commission, Washington 25, D. C. Order number is FPC S-93, and price is $3.75 per copy. A 20-page summary of the report is available for 25 cents.

Natural Gasoline

Suburban Propane Testing Salt-Dome Area for Storage

SYRACUSE, N. Y.—Suburban Propane Gas Corp. has started tests south of here in the western New York salt-dome area to explore the possibilities of storing L.P.G. in old salt mines.

Mark Anton, president, told a meeting of the Philadelphia Securities Association that drilling tests have been under way since late November and the first casing has been moved to the site.

The underground-storage reservoir is expected to enable the company to store up to 1,000,000 gal. of propane during summer months in preparation for heavy winter demands.

Padre Plant Operating

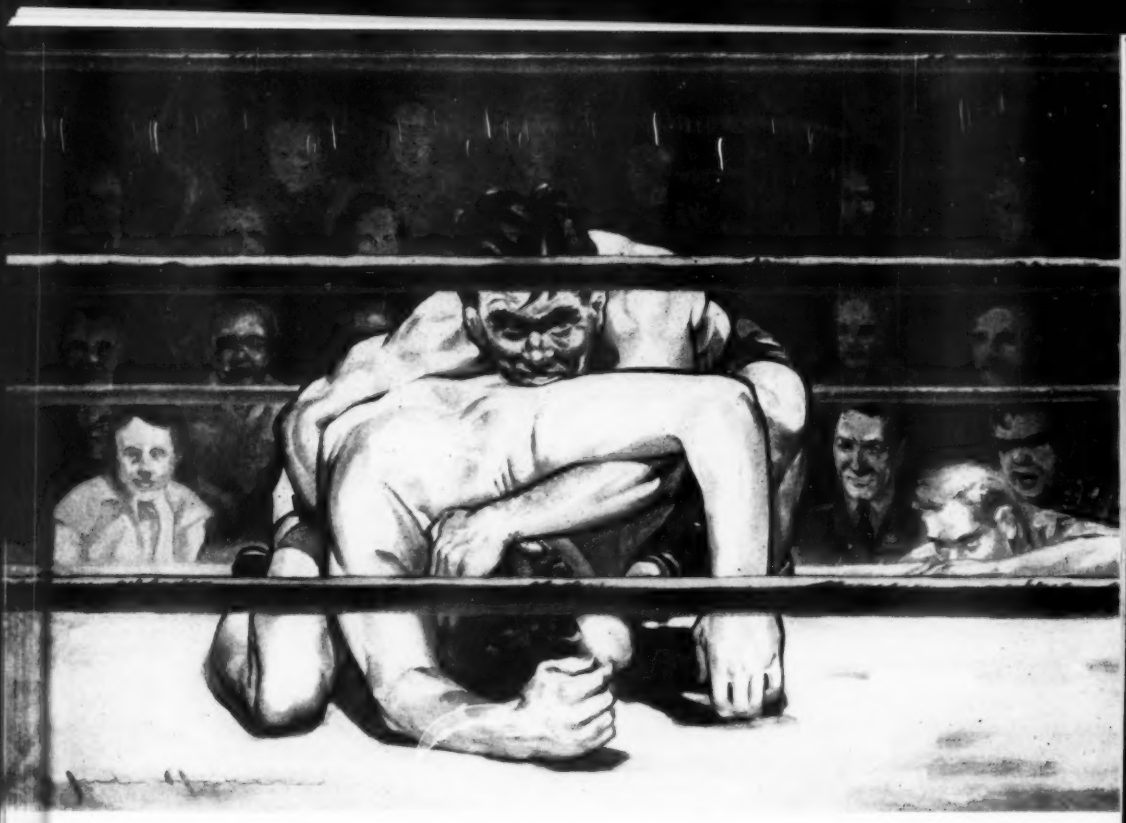
BROWNWOOD, Tex.—Padre Petroleum Co.'s new $500,000 natural-gasoline and cycling plant in the Bangs area of Brown County is now operating.

The plant is handling 10,000,000 cu. ft. of gas per day, from which it extracts natural gasoline, butane, and propane. Stripped gas is being reinjected.

Ringwood Plant Progresses

RINGWOOD, Okla.—Oklahoma Natural Gas Co. and Warren Petroleum Corp.'s new natural-gasoline plant in Ringwood field will be completed in April 1952.

The plant will process about 50,000,000 cu. ft. of gas daily for the manufacture of about 80,000 gal. of products per day. Construction is well advanced on a 12,500-hp. plant and 82 miles of gathering lines.



YOU GET BETTER RESULTS WITH NO FRACTURING

One well completion problem you no longer have to wrestle with is the unpredictable condition at the pay zone resulting from crude perforating methods that depend on fracturing of the cement sheath in order to obtain production. By perforating with the modern Welex JET method, you get *positive penetration* through all strings of casing and cement and far back into the producing zone. Your well produces oil through an intact assembly directly from virgin formation. There is *no burr, no fracturing,* and *no debris left in the well.* Records in the operators' files on thousands of wells perforated by the Welex Jet method prove that a *known condition at the producing zone* often eliminates many problems or makes it possible to deal with them in a positive manner. Results cost less with Welex Jets. . . . Call your nearest Welex Station for prompt service day or night.

ORIGINATORS OF Welex JET PERFORATING

Welex
JET SERVICES INC.

GENERAL OFFICE: 3909 Hemphill Street • Fort Worth 9, Texas
FIELD STATIONS: Ardmore • Lindsay • Shawnee • Corpus Christi
Hobbs • Falfurrias • Houston • Kilgore • Odessa • Wichita Falls

Among the

Drilling Contractors

Livermore Firm Changes Name to Great Western

Name of the drilling contracting firm formerly operated as George P. Livermore, Inc., has been changed to Great Western Drilling Co. The change does not affect company organization, officers and personnel, or policy, R. C. Tucker, president, announces.

The company, headquartering in Lubbock, Tex., has branch offices in Midland, Tex., Farmington, N. M., and Denver. It operates more than 20 rotary rigs in West Texas, Colorado, Oklahoma, and Kansas, and has substantial oil production of its own in these areas.

D & M Drilling Co., Wichita, has a rig working for **Anschutz Drilling Co.**, also of Wichita, at a wildcat location a mile northeast of the Brock field, in Stafford County, Kansas. The test is 1 Minnis, with location in the NE NE NW 8-23-11.

Tippett Drilling Co., Shreveport, is moving a rig to an outpost location northeast of the Bethany field, in Caddo Parish, Louisiana, where it will drill a Goodland lime test at 1 Taylor, 8-16n-16w, for West Pontiac, Inc., and Louisiana Machine Co., Inc., of Monroe, La. Contract is for 2,600 ft.

Mohawk Drilling Co., Oklahoma City, has two rigs under contract to Charles H. Mee, Oklahoma City independent operator. One is working on a wildcat in the NW SW NE 17-15n-4e, Lincoln County, Oklahoma. The other is on a location in the NW NW SE 5-16n-1w, 4 miles east of Guthrie, in Logan County.

Sterling Drilling Co., Sterling Kans., has a new wildcat job under way at a location 3½ miles northeast of the Merino field, Logan County, Colorado, where it is drilling for Lario Oil & Refining Co. at 1 Berwick, C N½ NE SW 12-6n-54w.

Loffland Brothers Co., Tulsa, is starting a new wildcat test for Carter Oil Co. in the Duchesne area, in Duchesne County, Utah. It is 1 Willis Moon, C SE SE 13-4s-4w.

E. L. & M. Drilling Co. is the contractor on a projected 4,000-ft. Cromwell sand test which M. P. Evans and Watson Joyce of Tulsa are starting at 1 Patterson, in the SW SW SE 33-12n-7e, Okfuskee County, Oklahoma.

Zephyr Drilling Corp., Tulsa

ZEPHYR DRILLING CORP., recent successor to The Zephyr Corp., is one of the more active drilling organizations in the Mid-Continent and West Texas regions. Headquartered in the new First National building at Tulsa, it also has division offices at 210 North Big Spring, Midland, Tex., for its West Texas-New Mexico operations. Currently, it has 10 rotary rigs in operation, 7 of which are in West Texas and 3 in Oklahoma.

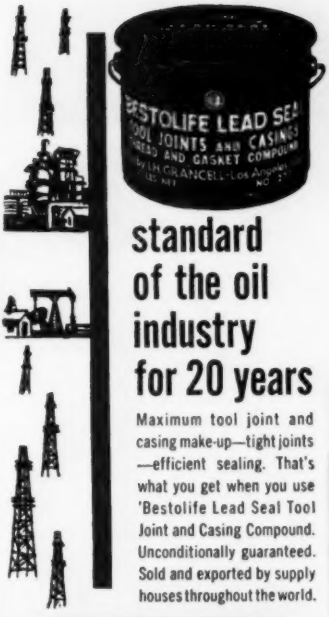
F. G. McCLINTOCK

S. C. CANARY

Officers.—Heading the company is F. G. McClintock as president. S. C. Canary is vice president; J. M. Winters, Jr., secretary; and G. Robert Dow, treasurer. J. Russell Yost is general superintendent with N. W. (Pete) Eaton, superintendent in Texas and New Mexico, and Harold (Hap) O'Brien, superintendent in Oklahoma.

History.—The company had its inception as the Zephyr Drilling Co., organized in December 1936 by R. Otis McClintock; his son, F. G. McClintock (president of the present company); and the late S. R. Mealy, Sr., and his sons. In 1938, the Mealy family disposed of its interests in the company to S. C. Canary (vice president of the present company).

In 1948, the company separated its drilling and oil producing activities and was replaced by two newly formed companies, The Zephyr Corp. and Zephyr Petroleum Co. The former took over all contracting and other drilling activities and was assigned all tools, except one rig, which was given the Zephyr Petroleum Co., the new producing company, for use



standard of the oil industry for 20 years

Maximum tool joint and casing make-up—tight joints—efficient sealing. That's what you get when you use 'Bestolife Lead Seal Tool Joint and Casing Compound. Unconditionally guaranteed. Sold and exported by supply houses throughout the world.

I. H. GRANCELL
1601 EAST NADEAU STREET
LOS ANGELES 1, CALIFORNIA

Play it Safe!

FASTEN WIRE ROPE WITH

CROSBY CLIPS

America's largest-selling DROP-FORGED fasteners!

SIZES for ⅛" to 3" WIRE ROPE
DISTRIBUTORS EVERYWHERE

AMERICAN HOIST & DERRICK CO.
ST. PAUL 1, MINNESOTA

Starrett "Oil Gager" STEEL TAPES

No. 507 ½" wide for heavy oils
No. 508 ⅜" wide for light oils

Approved by A.P.I. for use by engineers and oil gagers. Hardened steel frame, lock-type winding handle, removable hardwood grip, easy-reading tape graduated in feet, inches and eighths (also available in Metric). No. 507 furnished with 20¼ oz. bob for heavy oils. No. 508 with 5½ oz. bob for light crude, gasoline, etc.

WRITE FOR BULLETIN NO. 112 OG

THE L. S. STARRETT COMPANY · ATHOL, MASS., U.S.A.

Starrett

SINCE 1880
WORLD'S GREATEST TOOLMAKERS

BUY THROUGH YOUR DISTRIBUTOR MECHANICS' HAND MEASURING TOOLS AND PRECISION INSTRUMENTS · DIAL INDICATORS · STEEL TAPES · PRECISION GAGING FLAT STOCK · HACKSAWS, BAND SAWS and BAND KNIVES

Proved!

BY 14 YEARS USE

BY THE INDUSTRY

You're sure of leak-proof tubing couplings when you make them up with Rectorseal. The same is true about connections on your rig lines... mud, water, steam, diesel fuel, gas... your separator and tank battery lines.

For 14 years Rectorseal has been meeting the industry's need for a thread sealant that holds all petroleum solvents; that is economical; easy to apply; that won't freeze the connections; that is positively and permanently leak-proof.

Ask for RECTORSEAL AT YOUR SUPPLY STORE!

or write RECTORSEAL, Dept. D
2215 Commerce St., Houston 2, Texas

RECTORSEAL

Manufactured by
RECTOR WELL EQUIPMENT CO., INC.
Fort Worth, Texas

MAKING THE OIL INDUSTRY SAFER

in its own development work. S. C. Canary, vice president of the drilling company, heads the Zephyr Petroleum Co., with J. I. Hull, formerly general superintendent of the original Zephyr Drilling Co., as superintendent of production and drilling.

Effective December 1, 1951, name of The Zephyr Corp. was changed to Zephyr Drilling Corp.

Operations. — The original Zephyr Drilling Co. started with one rotary rig capable of drilling to depths of 6,000 ft. First operations were in Kansas. In 1938, operations were extended to Illinois, where an additional rig was put to work. Shortly later, two more rigs were added in Kansas, and with the subsidence of the active drilling play in the Illinois area in 1941 and 1942, the company moved all of its rigs to that state. Drilling was concentrated in Kansas until late in 1943, when the company drilled its first Oklahoma well. Operations were extended to West Texas in 1948, and in recent years all new drilling has been confined to that area and Oklahoma.

Rigs.—Rigs now being operated by the company are all of the most modern, heavy-duty, power-operated types. The 7 rigs in the West Texas area have rated capacities ranging from 8,000 to 16,000 ft. The 3 Oklahoma rigs are capable of drilling to depths of 8,000 ft.

Miscellaneous. — Zephyr tools have drilled approximately 500 wells, including a number of notable field discovery and extension producers. Among new pools opened are: Breedlove, Martin County, Texas, discovered this year; North Milroy and Southwest Sholem Alechem, Stephens County, Oklahoma, discovered in 1950; Florey, Gaines County, Texas, 1950; Northeast Elmore, North Foster, and Katie, Garvin County, Oklahoma, the first two in 1948 and the latter in 1946; and Hayburn, Creek County, Oklahoma, in 1941. Deepest well drilled was Forest Oil Corp. 1 School, discovery well of the Florey pool, total depth 14,150 ft. In addition to straight contracting, the company is taking numerous drilling deals, both in Texas and Oklahoma.

ACTIVE ROTARY RIGS*

(United States and Western Canada)

Area	Week ended 12-10-51	Change week ended 12-3-51	Change week ended 12-11-50
Gulf Coast	667	— 9	+ 64
W. Tex.-N. M.	1,069	— 6	+282
Ark.-N. La.-E. Tex.	195	+ 5	+ 32
Oklahoma	372	+22	+ 63
Kansas-S. Nebraska	203	+ 7	+ 42
Illinois-Eastern	146	— 3	+ 8
Rocky Mountains	190	—10	+ 76
Pacific Coast	179	— 1	+ 47
Total U. S.	3,021	+ 5	+614
Western Canada	160	+12	+ 46
Total	3,181	+17	+660

*Courtesy Hughes Tool Co. Trends in drilling activity in the United States and the Gulf Coast and Arkansas-North Louisiana-East Texas areas are shown on pages 406 and 407.

RUGGED— ACCURATE— EFFICIENT!

#3480
100 C.C.
CENTRIFUGE

You can maintain your required speed for the full period of the test with much less effort. Curtin centrifuges, proven world-wide, are heavy duty, rigidly constructed, and extremely simple in design. Illustrated bulletin, giving full details, available upon request.

W·H·CURTIN & CO.

HOUSTON . . . . NEW ORLEANS

Standco
NO-SMOKE

STANDCO BRAKE LINING

Stands the gaff and gets the job done without scoring brake rims. See pages 3608-3613, Composite Catalog.

Standco Brake Lining Co.
HOUSTON

M-SCOPE PIPE FINDER

MODEL AB
ONE MAN OPERATION
METAL CABINETS
HEAVY DUTY PERFORMANCE
ONLY
$149.50

FISHER RESEARCH LAB., Inc.
PALO ALTO CALIF.

Merry Christmas KELCO *Happy New Year*

BEN F. KELLEY CO., INC.

18 S. Madison Tulsa, Oklahoma Phone 3-1425

BAKERSFIELD, CALIF.
Ed. W. Plaugher
Wally Hays
Deane Maurel

LONG BEACH, CALIF.
George Winterburn

CASPER, WYOMING
Carl D. Moulden
Burt Moulden

ODESSA, TEXAS
J. G. Hollis
Bill Campbell

WICHITA FALLS, TEX.
C. Fager

Ben F. Kelley, President
W. L. (Bill) Kelley, Vice-Pres.
B. F. Kelley, Jr., Treasurer
Colonel Parsons
Elizabeth Hull
Norene Monroe
Elvena Phelps

WICHITA, KANSAS
Ray E. (Flash) Gorman

GREAT BEND, KANSAS
Ray Arnold
Noel H. Swick

MT. CARMEL, LA.
Harold Jarvis

HOUSTON, TEXAS
Marc A. Lamkin
Charles B. Jahn
Robert Ross
Marvin Peck
Jim Walters

CROWLEY, LA.
George K. Sutton

SHREVEPORT, LA.
H. C. Stewart, Jr.

OKLAHOMA CITY, OKLA.
Allan Nelson
Lowell Nelson
Ray Cash

YOUR KELCO REPRESENTATIVES

HIGH COSTS For Pump Repairs and Well Pulling

Due to Pump Trouble

ARE OBSOLETE

For Rod or Tubing Pumps

Save **UP TO 80%**
UP TO $2500.00

per year on a SINGLE well

And it may not cost you a cent . . . for in many cases the MARTIN PLUNGER costs no more than the replacement of your present plunger. MARTIN CAGES, with their long life, synthetic rubber ball guides, protect balls and seats and increase savings. Ask almost anyone around Freer or Smackover, or Oklahoma City, or wherever hard pumping conditions are found.

Sold thru your supply company.

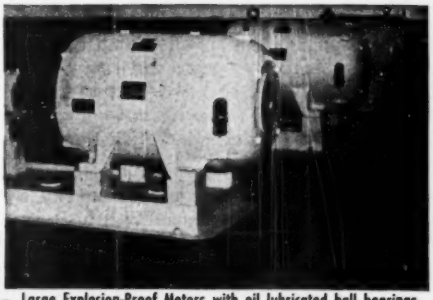
Field representatives:

E. W. Brockman, Tel. 9-3444, Oklahoma City
Don C. Davis, Tel. Wilson 8055, Ft. Worth
Tom Hulett, Tel. 3-4545, El Dorado, Ark.
L. K. Martin, Tel. 2-5317, Corpus Christi
J. L. Davis, Tel. MOhawk 4891, Houston

JOHN N. MARTIN
MANUFACTURER

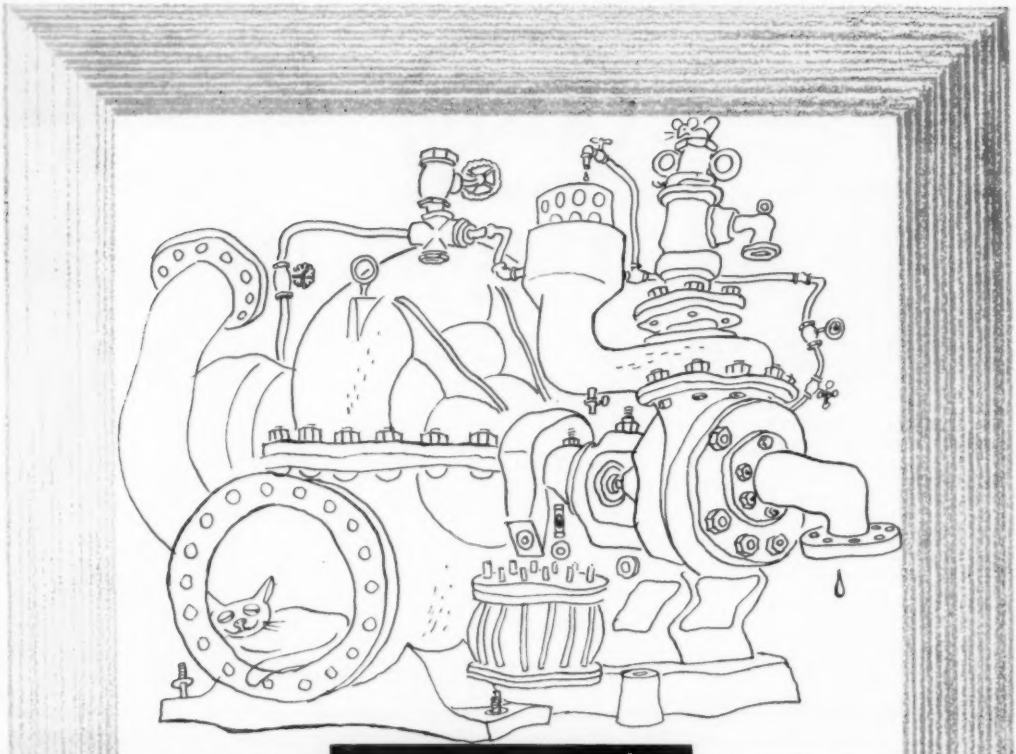
9 W. Brady St., Tulsa, Okla. Tel. 4-9415

Continental
EXPLOSION-PROOF MOTORS
1 to 700 h.p.



Large Explosion-Proof Motors with oil lubricated ball bearings.

CONTINENTAL ELECTRIC CO., INC.
325 Ferry Street, Newark 5, N. J.
Plants—Newark, N. J. and Rockford, Ill.



PICTURE OF A "Refinery Pump"

"Refinery" pump? There ain't no such animal. But if one pump could be all things to all processes, it *might* look like this. Fact is, however, that in refining *it's pretty important to have each pump fitted to its specialized job.* No *one* answer is good for all.

That's why Byron Jackson builds job-engineered pumps. With a BJ you're sure of a pump that sizes up to the need and is pin-point engineered to profitable performance. Starting with more than 25 basic BJ pump designs used in the refinery field, BJ engineers can incorporate features to meet particular pressure, temperature, corrosive, material or power requirements.

When you need a pump for your refinery operation—check with BJ first!

Byron Jackson Co.
Since 1872
P. O. Box 2017 Terminal Annex, Los Angeles 54, Calif.
OFFICES IN PRINCIPAL CITIES

SEE **BJ** FOR THE ENGINEERED ANSWER TO YOUR PUMPING PROBLEMS

REFINING

Petrochem Project

Shell starts $3,000,000 Montreal East facility

MONTREAL, Que.—Preliminary construction has begun on a $3,000,000 petrochemical project at the Montreal East refinery of Shell Oil Co. of Canada. First installation of its kind in that country, it will synthesize a reported 20,000,000 lb. annually of isopropyl alcohol and acetone from propylene.

The recent addition of a 10,000-bbl. per day fluid catalytic cracking unit at the 25,000-bbl. per day refinery made the new chemical program possible by greatly increasing the production of olefin gases. A mixed propane-propylene stream from the catalytic and thermal light-ends-recovery system will be diverted from polymerization to the new operation. The plant is expected to completed before the end of 1952.

Hydration process.—Isopropyl alcohol will be produced by the conventional hydration process, which Shell Chemical Corp. employs in existing plants in Texas and California.

In this process, the light hydrocarbon charge, stripped of C_3 and C_4 components, is contacted with concentrated sulfuric acid under pressure. The reactor effluent consists of isopropyl hydrogen sulfate, a so-called "fat acid" complex, plus unreacted propane. The latter is vented and recovered from the system in a separator, and the intermediate complex formed from propylene and acid is hydrated to form isopropyl alcohol, acid, and water.

Dilute acid separated as stripper bottoms, is reconcentrated and cycled to the reactor. The alcohol-water mixture is separated in two distillation stages. In the first column, a constant boiling mixture of 87.7 per cent alcohol and 12.3 per cent water is withdrawn overhead, and excess water is removed as bottoms fraction. The overhead azeotrope is further dried by distillation with benzene in the finishing column which produces a 99 per cent alcohol product.

Alcohol to acetone.—Some of the isopropyl alcohol will be converted to acetone, employing catalytic dehydration. In this process, the preheated charge to the fixed-bed converter yields a mixture of acetone, unreacted alcohol, and hydrogen. Hydrogen gas is vented from an accumulator, and the crude acetone is then fractionated to produce pure product and alcohol. Unreacted alcohol is cycled to the reactor.

The new Shell chemical plant will be operated as a separate refinery department. Because of the colder climate at Montreal, some minor design changes will be incorporated in the new plant. All apparatus and equipment will be housed.

The plant was designed by Shell Chemical Corp., and contract for construction has been awarded to C. F. Braun & Co. of Alhambra, Calif.

Republic Plans $7,000,000 Expansion at Texas City

TEXAS CITY.—A $7,000,000 expansion program has been announced for Republic Oil Refining Co.'s 38,000-bbl. refinery here. L. W. Robbie, vice president and general manager, said certificates of necessity have already been approved and work will begin in the near future.

Major units to be constructed at the plant include a crude-distillation unit—expected to increase the plant's charge capacity by 30,000 bbl. per day—and a 6,500-bbl. per day platforming unit for the production of aromatics and motor gasoline.

A second-floor addition to the laboratory building will add 4,000 sq. ft. of floor space, and additional dock, tankage, and power facilities will be constructed to handle the increased needs of the plant.

Work is expected to begin first on the platforming unit, with the distillation unit and other facilities to be constructed at a later date.

Asphalt Committee Advises Against Straight Ceilings

WASHINGTON.—The Asphalt and Asphalt Products Industry Advisory Committe has recommended that the Office of Price Stabilization make no effort at present to set dollars-and-cents ceilings for asphalt products.

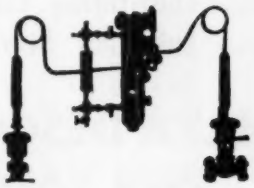
Meeting for the third time with OPS, members of the committee said no advantages would accrue in such a change in CPR 66, which now sets their ceiling prices, generally, at the highest prices charged during the base period, August 1, 1951.

Straight dollars-and-cents ceilings also would not be feasible at present because of administrative difficulties they would entail, members said.

The industry representatives did ask, however, that CPR 66 be modified to permit the pass-through of increased transportation costs. At present, the regulation has a cutoff date on transportation cost additions to ceiling prices of May 15, 1951, so that rate raises cannot be added.

They pointed out that some producers sell their products f.o.b. refinery and are not concerned directly with

INFERNO



Safety Sentinel

Inferno Boiler Safety Units pose triple-threat action against the danger of boiler explosions. The Inferno Feed-Water Control valve, Lowater Alarm and Fuel Cutoff Valve take the uncertain human element out of boiler operations, reduce costly boiler repairs, and furnish positive action for continued efficient operations. Sold direct or through your favorite supply store. Write for a copy of Bulletin 15-B.

The INFERNO CO.
Box 1138A
115 RICOU St.
SHREVEPORT, LA.

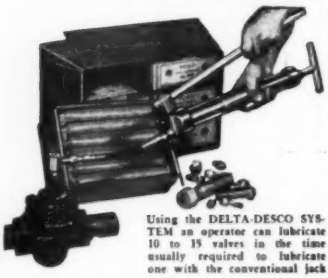
NICO Acoustical PHONE BOOTH

Cuts down industrial noises . . . Enables normal phone conversations to be maintained . . . Portable, easily attached to any wall or post. Weight 40 lbs. Size 2' x 2' x 3'. Wood and perforated hardboard construction. Reasonably priced. For details, literature, contact Dept. OGJ.

S. W. NICHOLS COMPANY, Inc.
5402 Bell — Houston, Texas — Phone WE 9311

Reduce **Plug Valve Costs**
Reduce **Lubricating Time**
Reduce **Lubricant Stocks**
by using the

DELTA-DESCO PLUG VALVE Lubricating SYSTEM



Using the DELTA-DESCO SYSTEM an operator can lubricate 10 to 15 valves in the time usually required to lubricate one with the conventional jack screw.

DELTA LUBRICANTS — Only 4 Desco Standard Service Lubricants and 3 Special Lubricants do the entire job. Packed in convenient, time-saving, individual barrel size sticks. Packed 12 sticks to a carton, 6 cartons in a case.

DELTA GUN — Lightweight, all steel, chrome finish. Easy to carry, easy to load. Fast snap-on, snap-off operation. Develops 10,000 pounds pressure.

DELTA FITTINGS — Quickly adapt any lubricated plug valve for Delta Gun. Single and double-check and combination lubricant screw fittings. High pressure, leak proof, safety tested.

DELTA-DESCO ENGINEERS supervise installation, recommend proper lubricants, train plant personnel, make periodic checks of all DELTA-DESCO Equipment.

WRITE FOR DELTA-DESCO CATALOG 14-O.

DELTA Automatic Plug Valve LUBRICATOR

A simple device, automatically lubricates valve each time it is opened and closed. Write for Lubricator Catalog 15-O.

The only Complete Plug Valve Lubrication Company

DELTA

DELTA-DESCO SYSTEM

ENGINEERING SALES CO.

806 Louisiana Avenue • Phone 5-2416

SHREVEPORT, LOUISIANA, U.S.A.

Sales Offices in All Principal Cities

transportation costs, whereas others sell on a destination-price basis and must absorb increases in transportation rates.

OPS officials said the agency is now studying the transportation situation in relation to cost increases from the standpoint of the impact such costs are now having and will have on the asphalt segment of the petroleum industry.

Companies represented at the hearing included Union Oil Co., Hunt Oil Co., Douglas Oil & Refining Co., Socony-Vacuum Oil Co., Shell Oil Co., The Texas Co., Saunders Petroleum Co., Standard Oil Co. (Ind.), Berry Asphalt Co., Standard Oil Co. (Ohio), Allied Materials Co., Byerlite Co., Skelly Oil Co., Esso Standard Oil Co., Trumbull Asphalt Co., Farmers Union Central Exchange, Ashland Oil & Refining Co., and Kerr-McGee Oil Industries, Inc.

Defense Agencies Optimistic Over Alkylate-Supply Boost

WASHINGTON.—Defense agencies are reported highly satisfied in regard to progress made in overcoming a shortage of aviation alkylate and expect supply to catch up with demand by the middle of next year.

The National Petroleum Association said a steady flow of replies has resulted from an appeal sent out in October by the Armed Services Petroleum Purchasing Agency offering some 150 refiners long-term protection of investments made in new alkylate facilities.

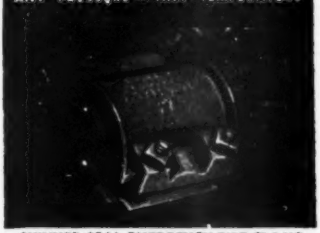
NPA said that proposals received did not meet Munitions Board requirements fully, but they were sufficient to justify an optimistic outlook. "Although no contracts have yet been made, negotiations have progressed sufficiently with several companies so that it now looks as if one or more will be signed immediately after the first of the year," NPA added. Others are expected to flow rapidly.

The purchasing agency offered investment guarantees and purchase contracts in an effort to boost usable alkylate production 31,000 bbl. daily over current capacity estimated at 127,000 bbl. per day. The agency was granted $82,000,000 by Congress for the expansion program

Refining Brief

The growing demand for synthetic fluid catalyst, arising from the expansion of European catalytic cracking operations, will be met in early 1953 by a new catalyst plant, the first to be built in continental Europe. The plant will produce a silica-alumina microspheroidal product. It is being constructed at Amsterdam, Netherlands, by a Dutch firm, Koninklijke Zwavelzuurfabrieken (Ketjen) under the terms of a contract signed recently with American Cyanamid Co.

TO REPAIR PIPE LEAKS—
QUICKLY, PERMANENTLY
ANY PRESSURE — ANY TEMPERATURE



SKINNER-SEAL EMERGENCY PIPE CLAMP for pinhole or corrosion leaks.

SKINNER-SEAL PIPE LINE CLAMP for long splits and bad corrosion leaks.

In stock—all oil well supply stores

M. B. SKINNER COMPANY
SOUTH BEND 21, INDIANA, U. S. A.

"GUNITE" CONCRETE
(SINCE 1915)
LININGS FOR

BUBBLE TOWERS • SETTLERS • STILLS • SEPARATORS • TANKS • AND VESSELS OF ALL TYPES • ENCASING AND FIREPROOFING STRUCTURAL STEEL AND PIPE • LINING WATER RESERVOIRS, DITCHES, DRAINS, AND CANALS • REPAIRING DISINTEGRATED CONCRETE AND OTHER MASONRY.

See our catalog in Sweet's

GUNITE CONCRETE & CONST. CO.
1301 Woodswether Road, Kansas City 6, Mo.
DISTRICT BRANCH OFFICES
Paul B. Watts, 228 N. La Salle St., Chicago 1, Ill.
George R. Lewis Co., 2036 Queen Avenue S., Minneapolis 5, Minn.
B. H. Mueller Co., 6625 Delmar Blvd., St. Louis 5, Mo.
Ole K. Olsen Co., 823 Perdido St., New Orleans, La.
Philip D. Barnard, 2036 Addison, Houston 5, Tex.
Western Steel Prod. Co., 1715 W. 13th Ave., Denver 4, Colo.

KAAR
RADIOPAK
***THE* MOBILE RADIOTELEPHONE**
KAAR ENGINEERING CO.
PALO ALTO CALIFORNIA

TANKER OR BARGE

DOCK

CHIKSAN MARINE & BARGE HOSE

LIGHT WEIGHT • EASY TO HANDLE

With the **CHIKSAN** aluminum Marine & Barge Hose, dock-to-vessel connections can be made by one man in just a few minutes. When not in service, the hose easily and quickly folds into a compact unit, without requiring disconnection from the Dock Riser. The same hose can be used for both suction and discharge.

MANY EXCLUSIVE ADVANTAGES

The **CHIKSAN** Hose, when used as shown, saves time, labor and expense, as well as dock space, and permits free movement of other equipment.

CHIKSAN Marine & Barge Hose, being made of metal, is not affected by severe climatic conditions or by petroleum products which may cause other hose to deteriorate rapidly. For the same reason, this all-metal hose is not subject to kinking, crushing or cutting—thus outlasting other hose.

CHIKSAN Marine & Barge Hose can be supplied in any required length and size, with end connections as specified, in either aluminum or steel, for above-surface or underwater service.

CHIKSAN TRADE MARK REG.

CHIKSAN COMPANY
AND SUBSIDIARY COMPANIES
Chicago 3, Ill. **BREA, CALIFORNIA** Newark 2, N. J.
WELL EQUIPMENT MFG. CORP. HOUSTON 1, TEXAS
CHIKSAN EXPORT CO. BREA, CALIFORNIA NEWARK 2, N. J.

WRITE FOR COMPLETE CHIKSAN CATALOG

REPRESENTATIVES IN PRINCIPAL CITIES
SOLD BY LEADING SUPPLY STORES EVERYWHERE

Specify this trap for

HIGH TEMPERATURES AND PRESSURES

Here's a trap capable of withstanding 800° total temperature and 500-pound pressure without danger of fracture! Made for ½" and ¾" pipe connections. This is the only forged steel steam trap available with all pipe connections in the head for straight-in-line or elbow connection, eliminating *extra expensive fittings.* Also permits the trap to be serviced *without disturbing a single fitting!* For further information, contact your nearby Super-Silvertop representative or mail coupon.

Head: SAE 1030 steel
Body: Steel forging
Valve and Seat: Anderloy
Head bolts: Heat treated alloy steel
Other parts: Stainless steel

THE V. D. ANDERSON COMPANY
1981 WEST 96TH STREET • CLEVELAND 2, OHIO

Please send the following:

☐ Details on new high pressure steam trap.
☐ 36-page book "Solving Steam Trap Problems."

Name .....

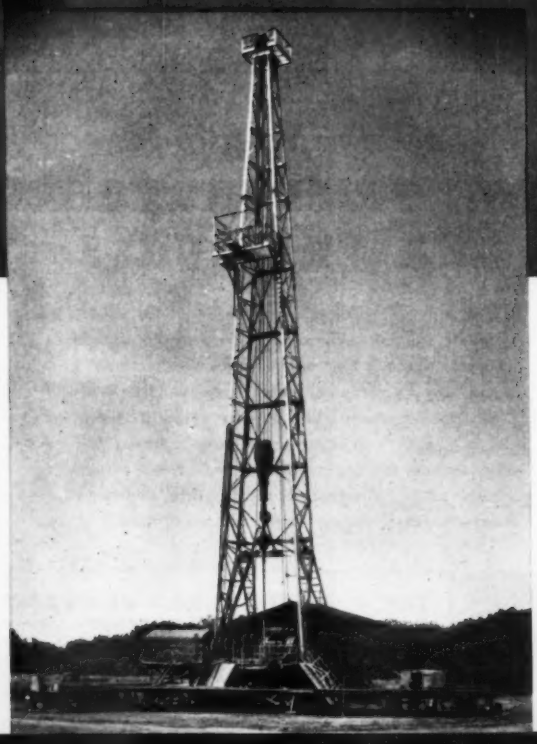
Address .....

City ..... *State* .....

In Canada: Bawden Machine Co., Toronto

LEE C. Moore

depend on LEE C. Moore engineering for *standard* and *specialized* drilling structures



Chances are there is a standard Lee C. Moore Mast or Derrick to meet your drilling requirements. However, when specially designed structures are required consult a Lee C. Moore representative for fast, progressive engineering service.

LEE C. Moore

LEE C. MOORE CORPORATION

TULSA • DALLAS • HOUSTON • MIDLAND • SHREVEPORT • WICHITA • CENTRALIA • PITTSBURGH

Export Office—9 Rockefeller Plaza, New York 20, N. Y.

Encouraging Signs in Anadarko Area

AT long last it looks as though the northwestern portion of the Anadarko basin is going to see a sufficient volume of deep drilling to prove (or disprove) the idea of many geologists that "here is real potential oil country."

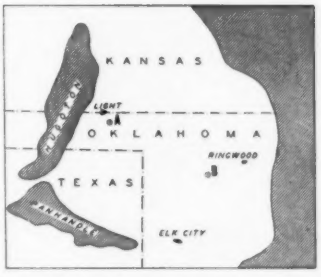
The alternately hot and cold western portion of the Anadarko basin, it was pointed out on this page in the May 24 issue, was currently hot, but wouldn't stay that way very long unless encouraging signs continued to develop. Surface work, core-drilling programs, and seismic mapping had developed nothing inviting to drill. If this area was to produce, encouragement in the form of successful wildcats was needed to keep rank wildcatters interested so that a substantial number of thoroughly tested holes would be dug.

That needed encouragement is at an all-time high since Flynn Oil Co. 1 School Land (A on map) flowed oil from open hole at 5,540-49 ft. on production tests (see News Section for details).

Interest in the area has been further heightened by the recovery of gas-condensate production from the Mississippian at 8,400 ft. in Continental Oil Co. et al 1 Kimball (B on map); and by Pure Oil Co. 1 Albert (about 15 miles east and 3 miles north of Flynn's discovery well), which drill-stem tested gas and condensate from the Pennsylvanian-Morrow at 6,710-74 ft.

Despite the lack of normally acceptable reasons for pinpointing a wildcat location in this vast area these recent discoveries, coupled with older, scattered gas-condensing discoveries near the Kansas-Oklahoma line and a few oil discoveries a little farther north in Kansas, indicate that Beaver and Harper counties, Oklahoma, and Meade and Clark counties, Kansas, are about to bust wide open. Wildcat locations based on structural trends developed from correlation of scattered wells drilled near the northern rim of the deeper portion of the Anadarko basin may soon be plentiful in these counties. These wildcats will be looking for the Kansas City-Marmaton reef buildup indicated in Flynn's discovery.

Last week this page reported that Flynn's production was coming from



reef. That statement was accepted as probable by some, possible by some, and improbable by others. That current disagreement will have a long history—perhaps may never be settled, because just what's reef, reef-like, near-reef, or just a very porous limestone is very much a matter of personal opinion. What one geologist may call a reef is just a porous limestone to another. Reefing is seldom clear cut. But, the fact remains that Flynn's well found an abundance of porosity over a thick section in an area where porosity has been at a premium; it found porous limestones where sandstones and shales were expected; it is in an area which regional geologic studies indicate offered ideal conditions for reef buildups.

Age determination of the producing formation is going to be another subject of disagreement. The called top of the Kansas City at about 4,570 ft. meets with rather general agreement. No in-place fossils have been found in samples taken below 5,220 ft. which is near where some geologists are calling the top of the Marmaton on the basis of the thickness of the Kansas City at the Kansas line (about 700 ft.). Others are calling the top of the Marmaton at a small silty shale break in the section at about 5,545 ft., some 300 ft. lower.

The stratigraphy of reefing limestones is a difficult problem. Reefs may grow to the surface of the water well ahead of deposition with a result that they will be found in younger and younger formations without a break in lithology—the reefs of Terry County, Texas, have shown growth from the Pennsylvanian into the Permian.

Samples from Flynn's well are now being studied in the laboratory of Stanolind Oil & Gas Co. These samples are fragmental and just how much can be determined from them remains to be seen. Thin sections will be made and compared to some of Kansas' Kansas City. Perhaps Stanolind's specialists can find the answers to the age and the character of the formations cut in the lower 300 ft. of Flynn's well. *Philip C. Ingalls.*

HIGHLIGHTS OF WEEK'S DEVELOPMENTS

WEST TEXAS.—Gulf Oil Corp. 1-EE TXL recovered 360 ft. of fluid, estimated to be 30 per cent oil, from top of the Devonian at 9,910-72 ft., and drilled ahead. Drill site is northeast Crane County, about 3 miles east of shallow production. Coroco Drilling Co. 1 Atlas Life, 93-D11-C&MRR, west-central Terry County wildcat, unloaded over 5,000 ft. of clean oil on drill-stem test at 8,292-8,351 ft. The section was reported as a limestone between two sand zones in the Clear Fork, with the possibility of its being Spraberry. If it proves to be the latter pay, it may mark a two-county north and west extension.

ROCKY MOUNTAIN AREA.—The Texas Co. and Amerada Petroleum Corp. are near completion on two Williston basin wildcats. Texas' Cedar Creek, Montana, well flowed through tubing with swab and line in the hole. Amerada's 1 Iverson, Beaver Lodge, North Dakota, discovery flowed through choke approximately 30 bbl. of oil per hour.

WASHINGTON.—Tom Hawksworth Oil & Gas Development Co. 4 Hawksworth, Grays Harbor area, was completed flowing 35 bbl. of 49°-gravity condensate and 300 M.c.f. gas daily from Miocene-Kincaid at 3,588-3,714 ft. (See News Section for details.)

North Central Texas

Continental Leases 23,000 Acre Block North of Dallas

WICHITA FALLS.—Week's developments were highlighted by first reports on new explorations, plus the leasing of a considerable block of acreage in a virgin area north of Dallas.

Chapman & McFarlin Producing Co. 1-A Abernathy, 15-D-H&TC, had drilling under way on a new operation for Stonewall County. The proposed 7,000-ft. wildcat is 6 miles east of Aspermont and 3 miles north of Canyon production in Flowers field. The same operator's 1 M. A. Baldwin, same section, was testing around 4,000 ft.

In Nolan County, Richardson & Bass staked location for 1 J. Jameson in 6-12-H&TC, one location east of the McCabe Pennsylvanian discovery in Mitchell County. A west offset was dry. A north offset was also to be drilled.

In Montague County, Wrather Petroleum Corp. staked locations for 1 and 2 C. Reimer, both in the M. A. Hunt Survey, 5 miles east of Montague and both scheduled to 7,200 ft. Martin Wunderlich staked location for 1 J. E. Rushing in Block 21, H&TC Survey, as a 6,100-ft. test, 1 mile northwest of Ringgold.

The new leasing, according to reports, involved some 20,000 acres by Continental Oil Co. and was based on the possible spread of Pennsylvanian production as found in the Saddler-Pennsylvanian strike by Mid-Continent Petroleum Corp. in northwest Grayson County. Details on the block had not been released, but it was said to extend southwest from Collin County across southeast Denton County, northwest Dallas County, and into northeast Tarrant County. Stanolind Oil & Gas Co., Magnolia Petroleum Co., Sinclair Oil & Gas Co., and Humble Oil & Refining Co. have been active in the same area in recent months.

NORTH CENTRAL TEXAS (DISTRICTS 9 AND 7-B) SUCCESSFUL WILDCATS

Coleman County: Ed Watts 1 S. E. Weaver Sec. 271, A. Gobel Sur., TD 1,940 ft., elev. 1,626 ft., Capps lime 1,870 ft., perforated 1,896-1,906 ft., IP pumped 47 bbl. 42°-gravity oil.

Eastland County: J. E. Connelly 1 A. Z Myrick, 67-3-H&TC, TD 4,038 ft., elev 1,649 ft., Caddo 3,182 ft., perforated 3,425-28 ft., IP 40 bbl. 43°-gravity oil, 1-in choke, TP 120 psi., GOR 2,500 cu. ft.

Jack County: Ben H. Rankin 1 Laura Ainsworth, G. Stephenson Sur., A-523, TD 4,428 ft., pay 4,295 ft., perforated 4,300-32 ft., IP 1,368 bbl. 42°-gravity oil, 30/64-in. choke, TP 460 psi., GOR 500 cu. ft.

Jones County: Woodley Petroleum Co. 1 N. A. Bagley, 18-15-T&P, TD 4,625 ft., elev. 1,709 ft., Strawn sand 4,497 ft., pay 4,499 ft., IP 198.7 bbl. 42°-gravity oil, 16/64-in. choke, TP 500 psi., GOR 880 cu. ft.

Nolan County: Union Oil Co. of California 1 TXL, 33-X-T&P, TD 6,013 ft., elev 2,474 ft., reef 5,085 ft., perforated 5,158-5,232 ft., IP pumped 120.6 bbl. 42°-gravity oil, TP 125 psi., GOR 1,200 cu. ft.

Stonewall County: Oxford Drilling Co. 2-A Lewis, 159-1-BBB&C, TD 6,109 ft., perforated 5,245-75 ft., IP 44 bbl. 43°-gravity oil, 12/64-in. choke, TP 50 psi., GOR 300 cu. ft.

Oxford Drilling 3-A Lewis, 159-BBB&C Sur., TD 2,656 ft., pay 2,625 ft., IP 163 bbl. 30°-gravity oil, 16/64-in. choke, TP 50 psi., GOR 270 cu. ft.

Moutray-Moore Oil Co. 1 O. M. Sparks, 161-1-H&TC, TD 5,459 ft., elev. 1,917 ft. perforated reef 5,246-88 ft., IP 126 bbl 40°-gravity oil in 10½ hr., 18/64-in choke, TP 100 psi., GOR 418 cu. ft.

NORTH CENTRAL TEXAS (DISTRICTS 9 AND 7-B) WILDCAT FAILURES

Archer County: Paul Bilberry et al 1 C. W Mankins, SPRR Sur., A-427, dry, TD 724 ft.

Virgil Taylor 1 J. J. Perkins, Perkins Subd., SPRR, dry, TD 1,560 ft., Gunsite 1,535-42 ft.

Baylor County: F. J. Pounds 1 Pounds & Sanders, Wm. Ahlert Sur., dry, TD 1,706 ft.

Callahan County: Arkansas Fuel Oil Co. 1 R. L. Griggs, Sec. 107, BBB&C Sur., dry, TD 4,421 ft., elev. 1,769 ft., Caddo 3,776 ft., Ellenburger 4,348 ft.

Sun Oil Co. 1 Mrs. I. E. Hill, Subd. 16, Victoria CSL, dry, TD 4,342 ft.

John H. Wilson 1 B. R. Blankenship, Sec 5, D&DAL Sur., dry, TD 2,173 ft.

Clay County: John & Pat O'Neil 1 Ray Blk. 73, Parker CSL, dry, TD 1,857 ft.

Coleman County: D. P. L. Co., Inc. 1 H. M. Parker, Sec. 113, ETRR Sur., dry, TD 3,725 ft., elev. 1,977 ft., Palo Pinto 3,000 ft., Morris 3,182 ft., Fry 3,240 ft.

Louis Franklin 1 J. L. Boggus, Blk. 7, Manuel Martinez Sur., dry, TD 1,540 ft.

Richard King, Jr. and Henry Flinn 2 A. C. Sparks, 85-1-GH&H, dry, TD 2,195 ft., Jennings 2,155 ft., Gardner 2,170 ft.

Cooke County: R. B. Hollandsworth 2 Lucy Spires Stark, Hunt CSL, A-400, dry, TD 2,456 ft.

Fisher County: Seaboard Oil Co. 1 Ralph Collins, R. Clayton Sur., dry, TD 6,902 ft., reef 6,178 ft., Ellenburger 6,858 ft.

Jack County: L. T. Burns 1 C. R. Starnes, Wm. Austin Sur., A-26, dry, TD 4,097 ft.

Shamrock Oil & Gas Corp. 1 Worthington, J. Wallace Sur., A-885, dry, TD 5,993 ft.

Jones County: W. M. Jarrell 1-A W. T Davis, 40-15-T&P, dry, TD 2,144 ft.

Montague County: Bolin Oil Co. 1 S. D Schrock, Thos. Scott Sur., A-661, dry, TD 2,663 ft., elev. 820 ft., Arbuckle 2,582 ft.

Palmer Drilling Co. 1 Barcus, Blk. 78, Kaufmann CSL, dry, TD 1,793 ft.

Palo Pinto County: Ashland Oil & Refining Co. 1 R. H. Gauldin, 1,734-A509-TE&L, dry, TD 1,700 ft.

Shackelford County: Andrew M. Housley 1-67 C. A. Nail, Sec. 67, ETRR Sur., dry TD 1,330 ft.

Are Your Oil Interests Closely Held or Family Owned?

This bank specializes in oil financing, particularly in connection with closely held or family owned oil and gas producing properties.

Oil and Natural Gas Department

Empire Trust Company
NEW YORK

Downtown Office:
120 BROADWAY
Equitable Building

Uptown Office:
7 W. 51st STREET
at Rockefeller Center

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

Taylor County: Miami Operating Co. 1 G. H. Blackburn, Sec. 59, BAL Sur., dry, TD 4,391 ft.
T. W. Murray 1 J. E. Bynum, Sec. 18, LAL Sur., dry, TD 4,554 ft.
Throckmorton County: Russell Maguire 1-A Buchanan, Sec. 922, TE&L Sur., dry, TD 1,882 ft.
H. J. Mosser 1 J. R. Cribbs, Sec. 3,014, TE&L Sur, dry, TD 4,995 ft.
E. J. Smith 2 L. L. Bellah, Sec. 915, TE&L Sur., dry, TD 4,528 ft., Caddo 3,870 ft., Barnett 4,468 ft., Mississippian 4,493 ft.
Wilbarger County: Baker Properties 1-B Waggoner, 17-5-H&TC, dry, TD 2,006 ft.
Young County: Brinson-Mills, Woodall Trust 1 J. A. McLauren, J. Fulkerson Sur., A-101, dry, TD 2,401 ft.
R. W. Darden 3 J. R. Burnett, Blk. 186, TE&L Sur., dry, TD 1,083 ft.
R. W. Darden 1 Joe Hunt, Blk. 185, TE&L dry, TD 1,061 ft.
R. W. Darden 2 Joe Hunt, 185-TE&L, dry, TD 1,064 ft.
Lebus Bros. 2 B. J. Heighton, W. Lemmons Sur., A-1,477, dry, TD 625 ft.
John H. Wilson 1 Dan Johnson, Sec. 25, TE&L, dry, TD 759 ft.

Oklahoma

Swabbing Tests Prove Beaver County Discovery

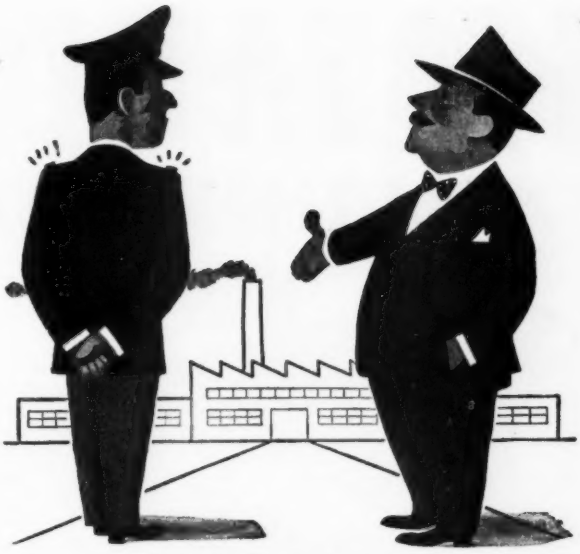
SWABBING tests carried on during the week at Flynn Oil Co.'s indicated oil discovery well 2 miles north of Beaver, in Beaver County, Oklahoma Panhandle, have virtually assured commercial production. Initially, the well, 1 School Land, SE SE SE 35-5n-23eCM, produced (by swabbing) at an average rate of 20 bbl. of oil per hour, making 120 bbl. in the first 6 hours, and 162 bbl. in another 8-hour period. Later, on a 12-hour gage, production dropped to an average of approximately 8½ bbl. of oil per hour, but it was indicated that the well had not cleaned itself entirely of drill-mud. As this is written, operators had applied 250 gal. of mud acid and were cleaning out to resume testing.

At one time, following initial swabbing, the well headed and flowed naturally for a period of a little over an hour, making 80 bbl. during that time. Production died but was revived by swabbing. Recovery during most of the time averaged around 20 bbl. per hour with gas estimated at 250,000 cu. ft. per day. Gravity of the oil was 36.5° A.P.I.

Operators still are undecided as to the age of the producing zone, which is a soft, porous lime, open at 6,540-49 ft. (total depth). The last definite marker was the Kansas City lime, topped at 4,584 ft. (—2,081 ft.)

Continental Oil Co. is drilling ahead after getting additional gas-distillate showings in its 1 Kimball, another promising Anadarko-basin wildcat located in the NW NW SW 34-20n-16w, 4 miles southeast of Chester, in southwestern Major County, just north of the Dewey county line. Latest reported showings, in Chester lime (Mississippian), were in a zone at 8,652-81 ft., where a 74-minute drill-stem test against a 1,500-ft. water cushion yielded 80 ft. of gas and distillate-cut mud. In a previous test at 8,382-8,428 ft., the well flowed at an estimated rate of 5,000,000 cu. ft. per day, and recovered 1,710 ft. of 56.5°-gravity distillate and 270 ft. of gas and distillate-cut mud in 74 minutes. Latest reported depth was below 8,850 ft.

Two additional pay zones, one in the Sycamore lime and the other in Hunton lime, and a half-mile extension of production are in prospect for the Eola field, in Garvin County. Present pay zones are in the Bromide-McLish sections. The indicated new-pay discovery and extension well is Sohio Petroleum Co. 1 Henthrone, SE NW SE 7-1n-2w. A 60-minute drill-stem test at 6,329-6,436 ft. in the Sycamore pay got gas in 8 minutes and filled 1,170 ft. of clean oil and 140 ft. of oil-cut mud. Hun-



on a business tour...
his investment's secure

With today's extended delays in replacements, dollars mean less and less protection, when fire strikes. No chance of extensive cutbacks in vital production, loss of day-to-day revenue or decrease in customer good will, when your investment in materials, equipment and buildings is fully protected from the ravages of fire with efficient, quick-acting C-O-TWO Fire Protection Equipment.

No matter what your property . . . factory, mill, warehouse, power station or research center . . . or a particular fire hazard such as spray booth, dip tank, pump room, electrical equipment enclosure or record vault . . . there is a type of C-O-TWO Fire Protection Equipment that gives you fast, positive action the instant fire strikes. Whether it's a C-O-TWO Squeez-Grip Carbon Dioxide Type Fire Extinguisher for an incipient fire, or a C-O-TWO Built-In High Pressure or Low Pressure Carbon Dioxide Type Fire Extinguishing System for total flooding an entire fire hazardous area . . . C-O-TWO means experienced engineering that assures you of the best type equipment for the particular fire hazard concerned.

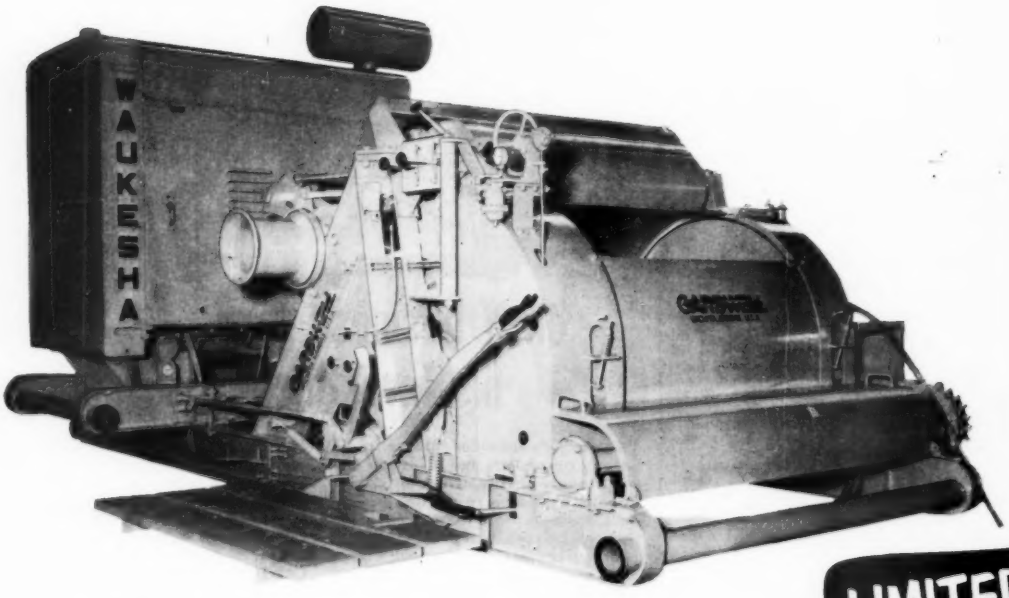
For example, at many locations a C-O-TWO Combination Smoke Detecting and Fire Extinguishing System is a "must." The first trace of smoke in a protected area sounds an alarm . . . then fast, clean, non-damaging, non-conducting carbon dioxide blankets the fire, putting it out in seconds, before it spreads and causes extensive damage . . . no after fire mess, no water damage with carbon dioxide.

So, whatever your fire protection problem, let an expert C-O-TWO Fire Protection Engineer help you in planning complete and up-to-date fire protection facilities now. Write us today . . . tell us about your particular fire hazards . . . no obligation.

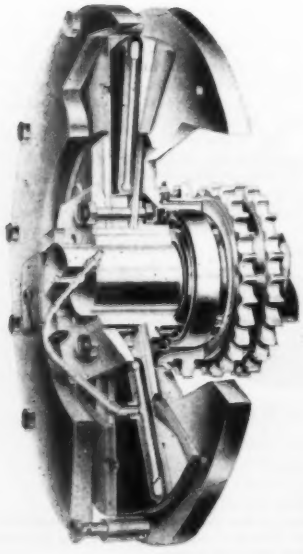
C-O-TWO

C-O-TWO FIRE EQUIPMENT COMPANY
NEWARK 1 • NEW JERSEY
Sales and Service in the Principal Cities of United States and Canada
Affiliated with Pyrene Manufacturing Company
MANUFACTURERS OF APPROVED FIRE PROTECTION EQUIPMENT
Squeez-Grip Carbon Dioxide Type Fire Extinguishers • Dry Chemical Type Fire Extinguishers
Built-In High Pressure and Low Pressure Carbon Dioxide Type Fire Extinguishing Systems
Built-In Smoke and Heat Fire Detecting Systems

IMMEDIATE
ON THESE CARDWELL



LIMITED



Model S, 4,500-Foot Draw Works

features..."Hi-Lo" drum drive, operated by "Flex-Disc" air friction clutches, makes it possible to double the line speed instantly without stopping the drum or block.

Cardwell five-speed and reverse transmission has even-ratio gear changes. This transmission, with its high torque capacity, makes possible the use of one large engine of high horsepower rating. Torque converter is available.

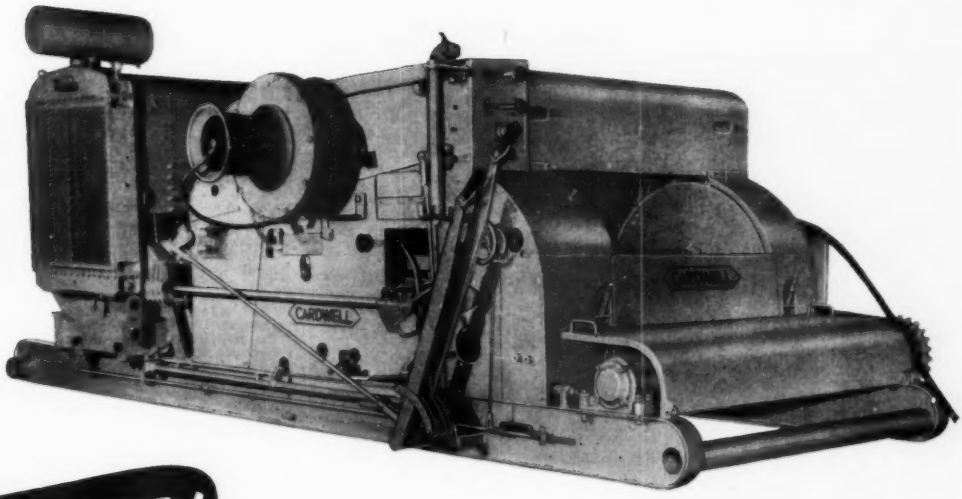
Rotary table drive is operated by an air friction clutch equipped with an air-operated rotary table brake.

Model S is available with the following engines for immediate delivery: Waukesha WAK, Waukesha WAKD, and General Motors 8103.

Cardwell "Flex-Disc" air friction clutches, standard equipment on Cardwell rigs, increase operating ease and speed. "Flex-Disc" air clutches are trouble-free, require no adjustment, are burn-proof and will last indefinitely without repairs.

DELIVERY!

"FLEX-DISC" DRAW WORKS



QUANTITY

Model L, 3,500-Foot Draw Works

features...Cardwell "Flex-Disc" air clutches, in the end of main drum and optional sand line drum, give fast, positive engagement when handling heavy hoisting loads.

"Hi-Lo" drum drive operated by "Flex-Disc" friction clutches, makes it easy to select either the high or low drum drive instantly.

Model L is available with either gear transmission or torque converter. Compact design and light weight (14,000 lbs.) make the Model L easy to move and rig-up,

Model L is now available for immediate delivery with the following engines: General Motors 6031C, General Motors 8107, Waukesha 145GK, and Waukesha 148DK.

REPRESENTATIVES

H. L. DeWEES
PHONE 3-312
ODESSA, TEXAS

CECIL HILLIARD
PHONE MOHAWK 3416
HOUSTON, TEXAS

E. R. JUKES
PHONE 6-1304
EVANSVILLE, INDIANA

WILLIAM HICKS
PHONE 549
MARLOWE, OKLAHOMA

CHARLES SPITZFADEN
PHONE 7-3311
WICHITA, KANSAS

RODNEY FREEMAN
PHONE TEMPLE 1544
NEW ORLEANS, LOUISIANA

LEN WALKER
PHONE 7-1554
CALGARY, ALBERTA, CANADA

CARDWELL
REG. U.S. TRADE MARK PAT. OFFICE
THIS TRADE MARK INSURES HIGHEST QUALITY AT LOWEST PRICE

CARDWELL MFG. CO. INC.

P. O. Drawer 2001 Long Distance Telephones 128—129—130
Cable Address "ALL STEEL" Wichita—"CARDSTEEL" New York
Wichita, Kansas, U.S.A.

OUR 25th YEAR SERVING THE OIL INDUSTRY

ton lime was topped at 6,539 ft. A 60-minute test at 6,542-89 ft. flowed gas in 7 minutes and recovered 1,200 ft. of oil and gas, 90 ft. of clean 39° oil, and 90 ft. of heavily oil-cut mud. Another test deeper in the section at 6,589-6,685 ft. got gas in 12 minutes and yielded 150 ft. of slightly gas-cut mud. Hole is being deepened to the field's regular pay zones.

Davon Oil Co. appears to have opened a new Bartlesville sand pool in Cleveland County at its 1 Hassman, NW NW SE 16-7n-1e. With hole open at 6,025-71 ft., the well swabbed initially 3 bbl. of oil per hour. Hydrafrac treatment was applied and the well recovered load oil and flowed 88 bbl. of new oil in 24 hours through tubing chokes. Gravity of the oil is 42.5°. Location is about 12 miles northeast of Lexington and about 4 miles west of the Cat Tail Springs pool.

OKLAHOMA SUCCESSFUL WILDCAT

Love County: Sinclair Oil & Gas Co. and Continental Oil Co. 1 Travis Sanders, NW SE NW 5-7s-1w, pumped 65 bbl. of 32.9°-gravity oil from perf. at 7,211-33 ft. and 7,304-30 ft., TD 9,414 ft., PBTD 7,368 ft.

OKLAHOMA WILDCAT FAILURES

Canadian County: Anderson-Prichard Oil Co. 1 Replogle, NE SW NE 18-11n-5w, dry, TD 10,102 ft.

Carter County: Christie-Stewart et al 1 Mary Morris, SE SE SE 23-2s-2w, dry, TD 3,015 ft.

Cotton County: J. Ben Russell 1 Carroll, SE SE SE NE 33-3s-13w, dry, TD 2,370 ft.

Creek County: Central Oklahoma Oil Corp. 1 Anthis, NE SE NE 7-16n-7e, dry, TD 3,301 ft.

Hughes County: Gulf Oil Corp. 1 B. E. Trumbo, SE SE SW 6-6n-11e, dry, TD 4,577 ft.

Lincoln County: Hubbell & Webb 1 Wentz, NW NW NW 12-15n-5e, dry, TD 3,722 ft.

Logan County: W. C. McBride, Inc., 1 Magnolia Petroleum, NW NW SW 29-15n-1e, dry, TD 5,684 ft.

H. D. Reeves 1 Carey, NE NE NE 30-17n-2w, dry, TD 6,250 ft.

Deep Rock Oil Corp. 1 E. L. Strickland, NW NW NE 5-17n-3w, dry, TD 6,313 ft.

Noble County: Hanlon-Boyle, Inc. 1 R. R. Ritthaler, NW SE SW 29-21n-2e, dry, TD 5,001 ft.

Okfuskee County: O. H. Rives 1 Replogle, SW NW SE 19-13n-8e, dry, TD 4,157 ft.

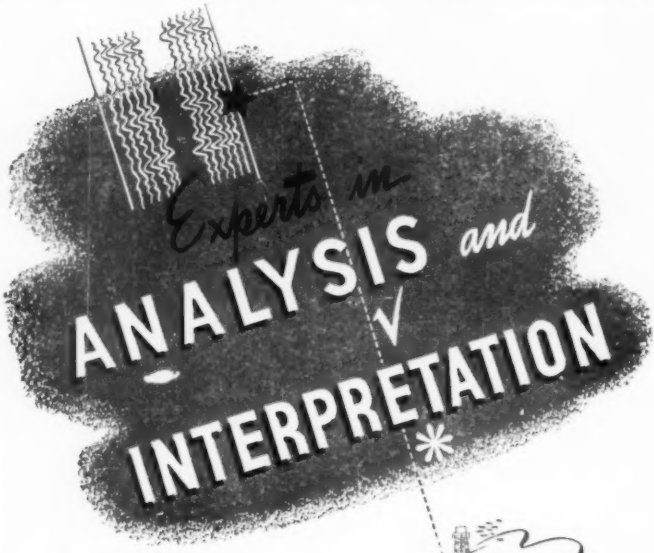
Oklahoma County: Peppers Refining Co. 1 Rodkey, NW NW NE 1-14n-2w, dry, TD 6,250 ft.

Payne County: Herndon Drilling Co. 1 Mullendore Trust, SW SW SW 31-19n-2e, dry, TD 5,061 ft.

Flynn Oil Co. 1 Hunt, NE NE SE 21-19n-3e, dry, TD 4,159 ft.

Jernigan & Morgan Oil Co. 1 Taylor, SE SE SW 1-19n-4e, dry, TD 3,560 ft.

Stephens County: D. H. Atkinson 1 Brennan, SE SE NW 5-3s-6w, dry, TD 2,575 ft.



But what is an expert? Webster says, "one who has a special skill or knowledge; a specialist." Certainly that includes the Republic personnel. Backed with the newest and finest equipment, much of which they themselves designed and manufactured, plus the experience in many years of successful exploratory work, Republic's Supervisors and Party Chiefs offer the producer the maximum in reliable analysis and interpretation.

In the field of surface shooting alone Republic crews have been successful in uncovering large areas that before were thought unworkable. In all geophysical operations it's equipment . . . skill . . . and integrity that pay off in successful surveys, so call on experts for the job—CALL ON REPUBLIC.

REPUBLIC EXPLORATION COMPANY

815 S. Boulder
TULSA, Oklahoma

407 N. Garfield
MIDLAND, Texas

Eastern Texas

Saddler-Pennsylvanian Strike In Grayson County Confirmed

DALLAS. — Mid-Continent Petroleum Corp. 2 Susie Martin, east offset and confirmation well to the Saddler-Pennsylvanian discovery of Grayson County, upheld all expectations and completed for a higher potential than did the discovery, Mid-Continent 1 Susie Martin completed for 252 bbl. of oil a day from pay between 6,912-93 ft.

The second completion gaged 309 bbl. of 36°-gravity oil a day, flowing through 16/64-in. choke, under tubing pressure of 275 psi and with gas-oil ratio of 517 cu. ft. The well had top of the oil sand at 6,880 ft. sand with oil shows around 6,880 ft., then cored 45 ft. of saturated sand between 6,888-6,933 ft.

Mid-Continent 3 Susie Martin, same survey, was in shale and sand at 4,492 ft.

In Big Mineral Creek field, Shell Oil Co. 2 Little, William Allen Survey, was drilling in shale at 3,382 ft. The well is a semiwildcat.

The Texas 2 Ida Webb, Carmena Survey, A-265, developed 435 ft. of free oil on a drill-stem test at 7,160-64 ft.

Standard Oil Co. of Texas 1 Bradshaw, wildcat 4 miles north of Dorchester, was drilling lime and shale at 8,096 ft.

R. W. Fair 1 Mason, J. Bartlett Survey of Marion County, completed as a Pettit limestone discovery. Potential was 233 bbl. of 42°-gravity oil a day through 3/16-in. choke, from perforations at 6,482-88 ft.

A new wildcat for Henderson County has been scheduled by F. William Carr as 1 C. W. Sawyer, B. C. Walters Survey. The proposed 8,500-ft. wildcat is 1 mile north of Athens townsite.

In Wood County, Felder & Erwin 1 W. L. Hulsey, 2 miles north of Golden, reported shows of oil in samples from the sub-Clarksville around 4,500 ft. Tests were not run at the time, and operators were drilling ahead below 5,720 ft. in the lower Woodbine. No shows had been reported in the Woodbine.

EAST TEXAS (DISTRICTS 5 AND 6) WILDCAT FAILURES

Cherokee County: Williamson & Phillips 1 Mrs. M. McDougal, J. Ford Sur., dry, TD 4,947 ft., Woodbine 4,938 ft.

Grayson County: Pure Oil Co. 1 J. Earl Selz, Wm. Richard Sur., A-998, 3 mi. E Tioga, dry, TD 4,702 ft., Strawn approximately 3,285 ft.

Houston County: New Seven Falls Co. 1 H. & G. Beasley, D. McLean Sur., dry, TD 6,244 ft.

Marion County: Ryan Consolidated Petroleum Co. 2 R. S. Terry, F. Spelling Sur., dry, TD 3,969 ft., Mooringsport 3,958 ft.

Rains County: Coats Drilling Co. 1 H. Brinestate, R. Finley Sur., dry, TD 8,504 ft., base massive anhydrite 7,980 ft.

California

Washington's First Oiler Completed Near Ocean City

LOS ANGELES.—The state of Washington has joined the ranks of the oil-producing states upon the successful completion of a wildcat near Ocean City in Grays Harbor County. The well was completed flowing 35 bbl. of 49°-gravity condensate and 300 M.c.f. of gas daily.

Designated the Tom Hawksworth Oil & Gas Development Co. 4 Hawksworth-State and located in 15-18n-12w, production was obtained from 126 ft. of fractured shale and sand above 3,714 ft., total depth.

The pay is known locally as the Kincaid zone and is believed to be of Miocene age. The condensate production was obtained through a 1½-in. bean with 1,000-psi. casing pressure and 900 psi. on the tubing.

In California, developments included the completion of a new oil discovery about ¾ mile east of the Playa Del Rey field in Los Angeles County and a new fault-block pool discovery at old Bardsdale field of Ventura County: The new Rosedale field of Kern County was given a ¼-mile southeast extension.

It also appeared likely that production would be extended ½ mile west at new North Arvin field southeast of Bakersfield. The potential extensioner was Havenstrite Oil Co. 1 Richards, in 22-31s-29e, ½ mile west of The Texas Co. 1 George discovery well. On a formation test at 6,640 ft., 120 ft. of gas-cut mud and some clean oil was recovered. After the test the operator continued coring and was at 6,725 ft. at the weekend.

The Rosedale extensioner was Humble Oil & Refining Co. 1 August Prunotto, ½ mile southeast of the discovery well and in 15-29s-26e. It was completed in the Stevens sand at 7,500 ft. for approximately 460 bbl. of 33.5°-gravity crude. Humble staked location for the field's third test, 2 Rosedale Stevens Community, two locations north of the discovery.

Also in Kern County an extension test slightly over ½ mile north of Fruitvale field showed promise of success. The wildcat, Norbel Oil Co. 1 Ansolabehere, topped an oil sand at 2,880 ft. and was drilled to 2,910 ft. before being halted to set 7-in. casing on top of the sand. Location of the prospective extensioner is SW NW 14-29s-27e.

At Sharktooth, also in Kern County, DeWitt Langford, Operator, 1 Bishop was credited as a new shallow discovery. Drilled to 2,600 ft. and plugged back to 2,267 ft., the wildcat was completed as a 100-bbl. pumper in the Pyramid Hills sand which was topped at 2,240 ft. Location of the discovery is NE SW 24-28s-28e.

At San Ardo field in coastal California, Jergins Oil Co. 24-12 Orradre extended production in the Lombardi sand about ½ mile southeast. Located in NE NW 12-23s-10e, the extensioner topped the Lombari at 2,218 ft. and found the water table at 2,358 ft. Before being completed in the Lombardi, however, Jergins was to test potentialities of 148 ft. of Aurignac sand topped at 2,642 ft.

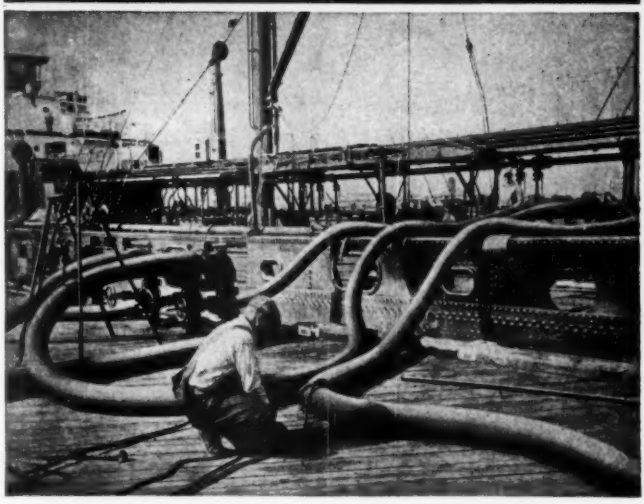
Near the Mexican border in Imperial County, The Texas Co. 1 Jacobs was preparing to whipstock at 5,955 ft. after redrilling to 6,300 ft. The company also was preparing for another wildcat in the San Felipe Hills area. The new test will be 1 Pure in 31-11s-10e, about 25 miles north of 1 Jacobs and 10 miles west of the south end of the Salton Sea.

CALIFORNIA SUCCESSFUL WILDCATS

Kern County, ¼-mile SE extension to Rosedale field: Humble Oil & Ref. Co. 1 August Prunotte, NE SE 15-29s-26e, IP: flowed 464 bbl. per day, perf. 5,895-5,912 ft., 33.5° gravity, 0.1 per cent cut, ¼-in. bean, TP 675 psi., TD 7,500 ft., elev. 370 ft.

Kern County, new deeper gas zone in Tejon Ranch field: Reserve Oil & Gas Co. 58-

FASTER because it's SMOOTH!



MONARCH OIL SUCTION AND DISCHARGE HOSE IS *Smooth Bore* FOR SPEEDY FLOW

Here's the faster, safer way for ship-to-shore unloading of oil and gasoline—even for intermittent service in carrying benzol and other aromatic fuels.

Unlike ordinary rough bore hose, Monarch Oil Suction and Discharge Hose is *smooth bore* (originated by Hewitt). There is no flow-retarding spiral of wire. Its smooth inner tube cuts friction to the minimum; it drains clean because there are no wire "fuel traps" inside. Result: You save up to half the time normally required to load or unload cargoes!

And faster flow is only one "plus" of this original Hewitt-Robins development. The specially-compounded tube can't pull loose; it's bonded to the tough duck carcass. No leakage either, because nipple and hose are cured together for perfect adhesion.

Oil Suction and Discharge Hose is but one of many Hewitt-Robins hoses specially engineered for the oil industry. For complete information, call your Hewitt Rubber distributor (see classified phone book—"Rubber Products" listing), or write Hewitt Rubber Division, 240 Kensington Avenue, Buffalo 5, New York.

HEWITT-ROBINS

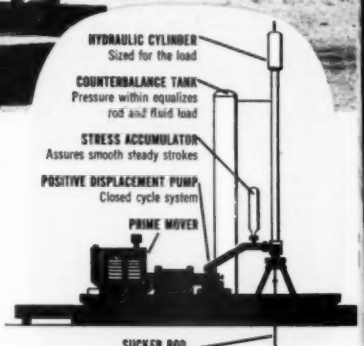
OIL SUCTION AND DISCHARGE HOSE

HEWITT-ROBINS HR **INCORPORATED**

BELT CONVEYORS (*belting and machinery*) • BELT AND BUCKET ELEVATORS
CAR SHAKEOUTS • DEWATERIZERS • FEEDERS • FOAM RUBBER PRODUCTS
FOUNDRY SHAKEOUTS • INDUSTRIAL HOSE • MINE CONVEYORS • MOLDED RUBBER GOODS
RUBBERLOKT ROTARY WIRE BRUSHES • SCREEN CLOTH • SKIP HOISTS • STACKERS
TRANSMISSION BELTING • VIBRATING CONVEYORS, FEEDERS AND SCREENS

PELTON

Long Stroke Hydraulic Pumping Jack



Here in a West Texas field is a typical installation of a PELTON Long Stroke Hydraulic Pumping Jack. This is the most modern, most efficient surface pumping unit ever devised for the sucker rod pumping of oil wells. With PELTON, each well may be pumped to its maximum potential and lifting costs reduced to the absolute minimum.

Hundreds of PELTON installations in Mid-continent and California fields have proved Long Stroke Hydraulic Pumping the most satisfactory method for pumping the deeper wells and the shallow wells with heavy production.

PELTON Jacks are available in seven models with polished rod load ratings from 20,000 to 40,000 lbs. Stroke lengths 10, 20 and 30 ft. The complete story on this modern and successful method of pumping is contained in PELTON's new catalog.

PELTON WATER WHEEL COMPANY *Subsidiary of Baldwin-Lima-Hamilton Corp.*
OIL INDUSTRY MACHINERY DIVISION
2447 East 54th Street, Los Angeles 58, California

LOS ANGELES • AVENAL • SAN FRANCISCO • DALLAS • ODESSA • HOUSTON • NEW YORK • PHILADELPHIA

33 "Well," SW SE 33-11n-19w, IP: flowed 3,000 M.c.f. through perforations at 4,727-4,857 ft., 16/64-in. bean, TD 4,893 ft., elev. 1,040 ft.

Ventura County, new Eocene sand fault-block pool in Bardsdale field: B. & B. Co. 1 Bardsdale, SE NW 7-3n-19w, IP: flowed 248 bbl. per day, perf. 6,488-7,538 ft., 32° gravity, 10 per cent cut, 28/64-in. bean, TP 300 psi., TD 7,538 ft., elev. 947 ft.

Los Angeles County, new pool discovery in east Del Rey field: Bolsa Chica Oil Corp. 1-1 Kidson, 22-2s-15w, IP: flowed 100 bbl. per day, perf. 7,375-85 ft., 28/64-in. bean, 31° gravity, 0.7 per cent cut, TD 7,418 ft., elev. unreported.

CALIFORNIA WILDCAT FAILURES

Kern County, Goose Slough area: Western Gulf Oil Co. 57-17 McAlpine Comm., 17-29s-25e, dry, TD 10,595 ft., elev. 305 ft.

Mount Poso area: Golden Bear Oil Co. 1 Roos, 35-26s-28e, dry, granite diorite 1,305 ft., TD 1,330 ft., elev. 1,176 ft.

Salt Creek area: Western Pet. Co. 55 Ferguson Western, 30-29s-21e, dry, Phacoides 2,113 ft., TD 2,150 ft., elev. unreported.

San Emidio Front area: Western Gulf Oil Co. 83-12 KCL-Rock Pit, 12-11n-22w, dry, TD 12,172 ft., elev. 598 ft.

Kings County, Reef Ridge area: O. M. Slosson 2 Reserve, 35-23s-17e, dry, TD 425 ft., elev. unreported.

Los Angeles County, Castaic area: Continental Oil Co. 1 Alexander, 23-5n-17w, dry, TD 4,851 ft., elev. 1,611 ft.

WASHINGTON SUCCESSFUL WILDCAT

Grays Harbor County, Ocean City area: Tom Hawksworth Oil & Gas Dev. Co. 4 Hawksworth - State, 15 - 18n - 12w, IP: flowed 35 bbl. 49°-gravity condensate and 300 M.c.f. gas from Kincaid (Miocene?) zone at 3,588-3,714 ft., 1½-in. bean, TP 900 psi., CP 1,000 psi., TD 3,714 ft.

South Louisiana

New Deep Pay Established in Cote Blanche Island Field

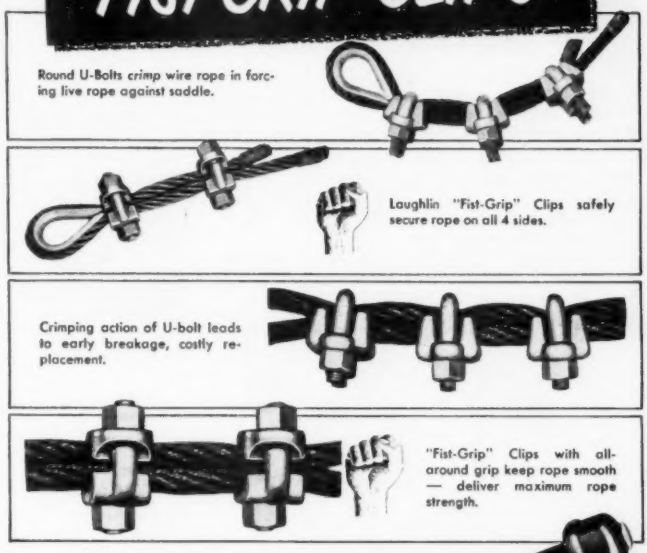
NEW ORLEANS.—New deep pay has been established in Cote Blanche Island field, St. Marys Parish, at The Texas Co. 20 Cote Blanche Island. From perforations at 14,387-14,426 ft., the well flowed 456 bbl. of 29.8°-gravity oil daily through 10/64-in. choke. Tubing pressure on the test was 2,400 psi. This well is located 1 mile east of the nearest production and is under water on State of Louisiana Lease 340. Hole is bottomed at 14,446 ft. with 5-in. casing run to total depth.

Humble Oil & Refining Co. has recompleted 1 Russell S. Baughman, et al, 46-1s-14e, for a new sand opener in Angie field, Washington Parish. The well flowed 132 bbl. of 59.6° - gravity distillate per day through 11/64-in. choke from perforations at 8,851-58 ft. This well was originally completed at 9,020-22 ft. as a shut-in gas well. The well went to salt water and was plugged in November of this year. Operator went back in the hole, reworked and perforated, and squeezed interval 8,964-74 ft. before recompleting in the new horizon.

Mar-Tex Realization Corp. has opened new pay in Mallard Bay field, Cameron Parish, at 2 A. S. White, 14-13s-3w. From perforations at 10,494-10,540 ft., the well was recompleted for 218 bbl. of 42.6°-gravity oil daily through ¼-in. choke. The well also had a flow of 7,680,000 cu. ft. of gas with the oil. Estimated open flow of the gas was 102,000,000 cu. ft. daily. This well was originally completed in August 1950, for 67 bbl. of 50.5°-gravity distillate from perforations at 10,348-70 ft.

The Texas Co. has prospects of a new field in St. Martin Parish at B-1 Iberville Land Co., 84-7s-8e. On 14-hour test of perforations at 9,914-28 ft., the well flowed at

Your wire rope stays stronger and lasts longer with "FIST-GRIP" CLIPS


Round U-Bolts crimp wire rope in forcing live rope against saddle.
Laughlin "Fist-Grip" Clips safely secure rope on all 4 sides.
Crimping action of U-bolt leads to early breakage, costly replacement.
"Fist-Grip" Clips with all-around grip keep rope smooth — deliver maximum rope strength.

You're SURE of these benefits with "FIST-GRIP" CLIPS

SAVES TIME — easy to put on with any type wrench.

SAFER — four-bearing-surfaces do not crush or weaken rope.

STRONGER — bolts integral part of saddle. Complete unit drop-forged.

SAVES MONEY — costs less per installation in most popular sizes.

SIMPLER — can't be put on backwards.

SURER — two clips do the work of three U-bolts.

Distributed through mine, mill and oil field supply houses.

New, Valuable Data-Book Free

The new Laughlin Data-Book #150 contains a wealth of valuable information as well as a regular listing of the complete Laughlin line of fittings.

SEND IN TODAY ... no cost or obligation

THE THOMAS LAUGHLIN CO.
512 Fore St., Portland 6, Maine
Please send Catalog-Data Book #150 to:

Name ..... Position .....
Company .....
Street .....
City ..... Zone ..... State .....

LAUGHLIN

THE MOST COMPLETE LINE OF DROP-FORGED WIRE ROPE AND CHAIN FITTINGS

Two New ALTEN UNITS that PUMP SHALLOW WELLS or WATER WELLS . . . . .

The moment you see these units you'll agree with the old saying "The best engineering provides the simplest design."

These units have been stripped of all frills, gadgets, and complex mechanical components . . . they have been engineered for *simplified* operation and they are *priced amazingly low.*

Next time you require a small unit buy an Alten. It will last long in service and keep repair costs cut to the bone.

FASTER, BETTER, AT LESS COST !

• Not entirely new. The limited number put to use for two years in several test areas are giving outstanding service

ALTEN

- Heavy steel structural parts
- Precision cut and shaved alloy steel gears
- Hardest gear-tooth surfaces
- High quality anti-friction bearings
- Revolutionary new adaptation of single Pitman design prevents overload by bringing bearing and Pitman into perfect alignment.
- Specially designed cable hanger allows quick, easy field changes and adjustments.
- Electric motor mount optional under Samson Post for convenience and compactness.

ASK FOR COMPLETE ALTEN LINE AT YOUR LOCAL SUPPLY STORE

ALTENS FOUNDRY & MACHINE WORKS INC.

LANCASTER, OHIO

the daily rate of 144 bbl. of 58°-gravity distillate through 16/64-in. choke. However, the company plans to squeeze off these perforations and come up the hole for more tests. The well spots in the Happytown field area of the parish.

Sun Oil Co. may have a new pay in Ellis field, Acadia Parish, at 1 Hensgens, 14-9s-1w. From perforations at 12,134-54 ft., the well flowed orange-colored distillate under tubing pressure of 8,400 psi. Operators killed off this zone, came up the hole, and perforated at 11,170-82 ft., from which the well flowed salt water. This zone was also abandoned, and operator will test farther up the hole. This is the deepest well in Ellis field.

SOUTH LOUISIANA SUCCESSFUL WILDCAT

Terrebonne Parish: New oil discovery—Humble Oil & Refining Co. 1 L. L. & E. "D," 32-19s-20e, in Bayou Jean La Croix area, TD 13,678 ft., perf. 13,231-34 ft., IP: 206 bbl. oil per day, 34.6° gravity, TP 4,850 psi.

SOUTH LOUISIANA WILDCAT FAILURES

Avoyelles Parish: Sinclair Oil & Gas Co. 1 Turner Lumber Co., 29-2s-6e, dry, TD 12,825 ft.

Plaquemines Parish: Shell Oil Co. 1 Shell-Helis State Lease 1762 Delacroix Unit 1, 7-16s-16e, dry, TD 10,500 ft.

Texas Gulf Coast

New Gas-Condensate Pool Opened in Matagorda County

HOUSTON. — A new gas-condensate pool has been opened in Matagorda County at Humble Oil & Refining Co. 1 South El Maton Gas Unit, David Ness Survey. From perforations at 10,700-04 ft., the well flowed 125 bbl. of 48.3°-gravity condensate plus 1,300,000 cu. ft. of gas daily through ¼-in. choke. Tubing pressure registered 5,200 psi. This well is located 3½ miles south of Wilson Creek field.

Ginther, Warren & Ginther are preparing to run 5½-in. pipe in the Jasper County wildcat, 1 Temple Lumber Co., to test shows encountered in Yegua sand. The hole is bottomed at 8,062 ft., and pipe will be set to 7,320 ft. Sand was encountered from 7,166-7,320 ft., with the best section being at 7,166 ft. This wildcat is located in A. Montgomery Survey, Abstract 371, 5 miles west of Buna field, nearest production.

L. D. French 1 Earl H. Roesner, wildcat in the Katy area of Fort Bend County, has been completed in the Watson sand. From perforations at 6,852-57½ ft., the well flowed 5 bbl. of 41°-gravity oil per hour. Through 11/64-in. choke, the well gaged 2½-3 bbl. hourly. This well is located about midway between Union Producing Co.'s Feeney wells and The Texas Co. 1 Finfrock, gasser. Correlation indicated the new oiler to be higher than The Texaco well and slightly lower than the Union wells.

Magnolia Petroleum Co. has encountered slight oil and gas shows in 1 Bill Rodgers, wildcat 3 miles northeast of Berclair and 1½ miles east of Berclair field production in Goliad County. Drill-stem test at 2,171-87 ft., using ¼-in. chokes, had recovery of 20 ft. of gas-cut mud. Another test at 3,206-10 ft., also had recovery of 20 ft. of gas-cut mud in 30 minutes. Venture is now coring ahead below 3,300 ft.

Two miles north of Beeville field, Bee County, J. M. Hancock and Marion M. Young are preparing to test a Frio sand at 3,018-22 ft. at 1 May R. Klipstein, wildcat in Bee County School Land Survey, Abstract 87. The well is bottomed at 4,525 ft. in Vicksburg, and casing set to 3,086 ft.

TEXAS GULF COAST (DISTRICTS 2 AND 3) SUCCESSFUL WILDCATS

Live Oak County: Gas discovery—Lee Bros. Oil Co. 1 Clyde Boothe, M. B. Kivlin

HENRY H. PARIS DISTRIBUTOR Inc.

Manufacturer's Agent - Oil Well and Refinery Supplies

P. O. BOX 932 — 1125 ROTHWELL ST.

HOUSTON, TEXAS

Agent and Distributor for the following Nationally Known Manufacturers:

W. C. NORRIS MANUFACTURER, INC.
Tulsa, Oklahoma
Quality Pumping Equipment, Swage Nipples, Bull Plugs, Welding Fittings, etc.

WHEELING MACHINE PRODUCTS CO.
Wheeling, West Virginia
XL Steel Pipe Couplings for OIL COUNTRY TUBULAR PRODUCTS.

THE OHIO INJECTOR COMPANY
Wadsworth, Ohio
OIC VALVES Bronze, Iron, Cast and Forged Steel for all purposes.

HARRISBURG STEEL CORPORATION
Harrisburg, Pennsylvania
Forged Steel Flanges and Seamless Casing Couplings

DRESSER MANUFACTURING DIV.
Bradford, Pa.
Seamless Welding Fittings.

VOLCANO BURNER COMPANY
Houston, Texas
Volcano Superior and Gulf States All Steel Gas Burners for OIL COUNTRY BOILERS.

OIL STATES EQUIPMENT COMPANY
Houston, Texas
OSECO Silvertop Fusible Plugs with renewable inserts for all types Oil COUNTRY BOILERS.

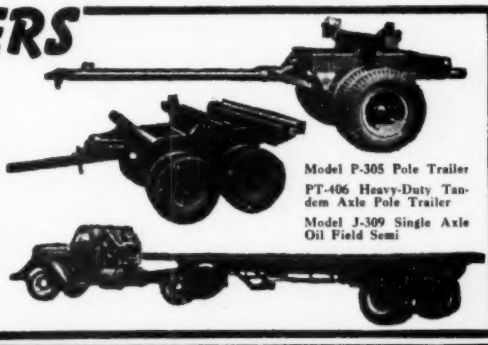
WESTERN SAFETY BARREL STAND
Houston, Texas
Stand lifts, holds, tilts 55 gal. barrels. Prevents spillage—easily loaded.

STEEL FORGING, Inc.
Shreveport, La.
Weld Saddles and Weld Sleeves

OIL FIELD TRAILERS

GENERAL PURPOSE OR SPECIAL

Since Fred G. Spencer built the first oil trailer 35 years ago, this name has stood for leadership. Constant engineering improvements of the several models have made these trailers the most popular in the industry. You'll find understanding of oil industry needs when you call Spencer-Safford Loadcraft. *Early* delivery on *standard models.*



Model P-305 Pole Trailer

PT-406 Heavy-Duty Tandem Axle Pole Trailer

Model J-309 Single Axle Oil Field Semi

Spencer-Safford LOADCRAFT Inc.
AUGUSTA, KANSAS
SUCCESSORS TO SPENCER TRAILER CO.
ESTABLISHED 1916

Phone 82, Augusta, Kansas, or wire Spencer-Safford Loadcraft for detailed information on pole type, flat beds or vans.

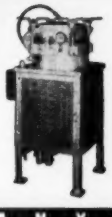
HILCO LUBE AND FUEL OIL PURIFICATION FOR DIESEL AND GAS ENGINES . . .

PURIFIERS · FILTERS · RECLAIMERS · CONDITIONERS

THERE'S A HILCO FOR EVERY LUBRICATION AND FUEL OIL FILTERING PROBLEM . . .

YOU WANT CLEAN OIL AND CLEAN ENGINES TO SAVE EQUIPMENT - OIL AND MONEY - INVESTIGATE HILCO OIL MAINTENANCE METHODS

★ ***WRITE FOR FREE LITERATURE - NO OBLIGATION***



• THE HILLIARD CORPORATION, 23 W. FOURTH ST., ELMIRA, N. Y. •

IN CANADA — UPTON-BRADEEN-JAMES, LTD. — 990 BAY STREET, TORONTO, 3464 PARK AVE., MONTREAL

Sur., A-21, TD 4,200 ft., perf. 3,270-80 ft., IP: 3,140,000 cu. ft. of gas daily, open flow, SIP 1,300 psi.

Matagorda County: Gas condensate discovery—Humble Oil & Refining Co. 1 South El Maton Unit 1, David Ness Sur., A-429, TD 10,900 ft., perf. 10,700-04 ft., IP: 124 bbl. condensate per day, 48.3° gravity, TP 5,200 psi.

TEXAS GULF COAST (DISTRICTS 2 AND 3) WILDCAT FAILURES

Brazoria County: Humble Oil & Refining Co. 1 C. W. Massey, Geo. C. Smith Sur. 22, A-548, dry, TD 8,540 ft.

Colorado County: Texas State Drilling Co. 3 J. F. Walker, J. E. Smith Sur., 11 mi. SW of Columbia, dry, TD 9,520 ft.

Fort Bend County: Cecil Hagen 1 L. Cummings, Jr., S. Pharr Sur., 5 mi. E of Long Point, dry, TD 8,009 ft.

Goliad County: Boyce-Smiser-Runion Co. 1 S. E. Crews, Maria Jesusa De Leon Sur., A-22, dry, TD 5,512 ft.

Hardin County: J. C. Chance Well Service, Inc., 1 Nona Mills, I. D. Hamilton Sur., A-249, dry, TD 9,783 ft.

Hunt Oil Co. 1 Mrs. M. B. Teel et al, McKinney & Williams Sur., 1 mi. SE of Saratoga, dry, TD 2,109 ft.

Hunt Oil Co. 3 Mrs. M. B. Teel et al, McKinney & Williams Sur., dry, TD 3,500 ft.

Jackson County: Hassie Hunt Trust 1 "L" Ranch Co., R. R. Royal League, A-67, dry, TD 10,017 ft.

Liberty County: Atlantic Refining Co. 1 J. M. Neal, Edward Tanner Sur., A-353, dry, TD 8,515 ft.

Live Oak County: Morris Cannan and Texita Oil Co. 1 Mrs. G. Frederick, J. Curry Sur., A-431, dry, TD 5,245 ft.

Harry Hotchkin 1 Schultz Live Stock Co., W. J. G. Pearce Sur., A-318, dry, TD 2,038 ft.

Matagorda County: Stanolind Oil & Gas Co. 1 Pierce Estate, Robert Reggs Sur., A-117, dry, TD 8,605 ft.

Refugio County: Clymore Petroleum Corp. 1 J. W. McGuill, Redmond & McGuill Sur., A-55, dry, TD 6,473 ft.

Sam E. Wilson, Jr., 1-D Mrs. Phil Hynes, Powers & Hewetson Sur., dry, TD 6,473 ft.

Victoria County: Arnold O. Morgan 2 J. B. Shiller, M. A. Castannon Sur., A-146, dry, TD 5,000 ft.

Wrather Petroleum Corp. 1 Dennis O'Connor et al, SA&MG RR Sur., dry, TD 4,776 ft.

Wharton County: J. B. Wheeler, Trust, 1 Lacy W. Armour et al, Thomas Westall Sur., dry, TD 6,012 ft.

PIPELINES
are not
SIDELINES
with WILLIAMS BROTHERS!

★

Years of experience have specialized our men, methods, and equipment—with only one purpose . . . BETTER PIPELINES.

WILLIAMS BROTHERS

ENGINEERS
CONTRACTORS
Oil—Gas—Products—Water
Pipelines and Pumping Stations

TULSA
NEW YORK
ATLANTA
LOUISVILLE

CARACAS • MARACAIBO • BOGOTA • LA PAZ

Kansas

Meade County Wildcat Tests Morrow Production

MEADE County, in the southwestern part of the state, has another prospective new Morrow sand discovery where Alpine Oil & Royalty Co. is starting production tests at its 1 Bromwell, C SW NW 7-34-29. Location is about 3½ miles northeast of the East Adams Ranch gas-distillate field in the extreme southwestern part of the county. It is about 6 miles north of the Oklahoma line, adjacent Beaver County, and about 12 miles north of the new Flynn Oil Co. discovery well in that county (see Oklahoma report) which has inspired a widespread lease play through that general region.

The new Alpine discovery well logged top of the Morrow (lower Pennsylvanian) shale at 5,861 ft. and the sand at 5,899 ft. A drill-stem test with bottom 9 ft. in the sand got a gas flow in 19 minutes. Tester was open 60 minutes, recovering 90 ft. of free oil and 360 ft. of oil and gas-cut mud. Another test with hole deepened to 5,915 ft. and taking in an interval below 5,907 ft. yielded 80 ft. of oil. Present total depth is 6,180 ft. in the Mississippian topped at 5,964 ft. and in which the production string of casing (5½-in.) was run to 6,021 ft. for completion. Surface elevation is 2,657 ft.

On the opposite (eastern) side of the county, another wildcat, Deep Rock Oil Corp. 1 Horner, C NW NW 29-33-26, has encountered promising gas showings in the Mississippian section. During a drill-stem test of an interval at 5,734-63 ft., the well flowed at an estimated rate of 785,000 cu. ft. of gas per day. Tester was open 53 minutes. Indicated bottom-hole pressure was 2,020 psi. Another test deeper in the pay at 5,770-5,825 ft. failed and got only mud. Location is about 4 miles northwest of the McKinney gas pool.

Deep Rock also has a prospective discovery well in Rooks County, where its 1 Gosselin, SW SW SW 12-8-20, has casing run to test showings encountered in both the Lansing-Kansas City lime and Arbuckle zones. Nearest production is in the Webster pool, 4 miles to the southeast. Best showings were in the upper zone, in which a 60-minute drill-stem test at 3,195-3,221 ft. yielded 385 ft. of oil. Indicated bottom-hole pressure was 1,060 ft. Total depth is 3,480 ft.

Bartlesville sand production has been opened in a wildcat located a mile east of the Baird pool, in Cowley County, in the extreme southern part of the state. The new producer is Crest Petroleum Co. and National Cooperative Refinery Association 1 Morgan, N ½ SW NW 22-34-3e. Initial tests by swabbing yielded 20 bbl. of fluid, 5 per cent water, per hour. Pay is open at 3,281-3,302 ft.

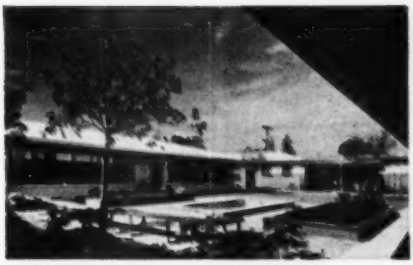
Earl Cave and associates 1 Bemis, SE SE NE 32-12-19, a mile northeast of the Irvin North pool, Ellis County, swabbed at an average rate of 8 bbl. of oil per hour while testing showings encountered in Arbuckle lime. Total depth is 3,894 ft. with top of the pay at 3,886 ft.

KANSAS SUCCESSFUL WILDCAT

Barton County: Pickrell 1 Putnam, SW SW SW 1-17s-14w, pumped 287 bbl. oil, no

first in the geophysical field

with the newest and finest facilities



United's new spacious plant at Pasadena, California, affords the petroleum industry with extensive facilities devoted exclusively to geophysical purposes. Modern in every respect and containing the very latest in equipment, this plant was designed to provide the very finest possible world-wide geophysical exploration services.

UNITED

Geophysical Company

SEISMOGRAPH • GRAVIMETER • MAGNETOMETER

Herbert Hoover Jr., Pres.

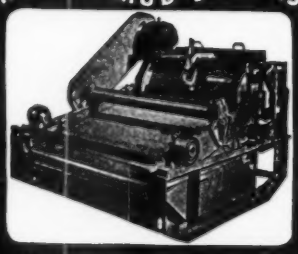
1200 SOUTH MARENGO AVENUE, PASADENA 5, CALIFORNIA

Tulsa, Houston, Midland, New York, Fairbanks, Calgary

APARTADO 1085, CARACAS, VENEZUELA

Rio de Janeiro, Brazil; Santiago, Chile; Bogota, Colombia; Kuwait, Persian Gulf

PERRAULT
X-TRUDE
THERMO-PLASTIC PIPE
FOR
THE OIL INDUSTRY
THE GAS INDUSTRY
FRESH WATER SYSTEMS
SALT WATER SYSTEMS
"Everything for the Pipeliner"
PERRAULT Brothers
1130 NO. BOSTON,
TULSA, OKLA. • 5-1103
Export Office:
30 ROCKEFELLER PLAZA
NEW YORK, N.Y.
CIRCLE 6-6260

OVERSTROM
VIBRATING
ROTARY MUD SCREENS

OVERSTROM'S 4½' x 5' heavy duty mud screens have earned and won the acceptance of drilling operators throughout the world. The proven product of 25 years experience in designing vibrating screen equipment.
Also available in sizes 3' x 4' and 2' x 4' in single or dual units.
Write to Oil Equipment Division for bulletin MS-20-B or see Composite Catalog.
OVERSTROM & SONS
ENGINEERS AND MANUFACTURERS
2213 West Mission Road
Alhambra, California, U. S. A.

water, from Lansing-Kansas City at 3,225-33 ft., TD 3,530 ft., PBTD 3,245 ft.

KANSAS WILDCAT FAILURES

Barber County: Prime Drilling Co. et al 1 Dickerson, C NE SE 29-31s-15w, dry, TD 5,242 ft.

Deep Rock Oil Corp. 1 McBrayen, SE SW NW 26-34s-14w, dry, TD 5,495 ft.

Barton County: E. H. Adair 1 Melton, CEL NE SW 1-20s-14w, dry, TD 3,545 ft.

Butler County: Aikman & Braden 1 Coulter, CEL E/2 SE 14-27s-5e, dry, TD 3,785 ft.

E. B. Shawver 1 McKay, NW SE SW 27-29s-3e, dry, TD 3,285 ft.

Ellis County: Globe Oil Co. 1 Gerkin, SE SE SE 24-13s-20w, dry, TD 3,943 ft.

Graham County: Cooperative Refinery Assn. and Northern Ordnace 1-A Griffith, NE NE NE 25-10s-23w, dry, TD 4,180 ft.

Hodgeman County: D. R. Lauck 1 Charles, NW SE SE 24-23s-25w, dry, TD 4,858 ft.

Norton County: Empire 1 Muir, NW NW SE 31-43-23w, dry, TD 3,845 ft.

Rooks County: Jones, Shelburne & Farmer 2 Rinner, NW NW NW 31-9s-20w, dry, TD 3,002 ft.

Rush County: Solar 2 Tammen, NE NE SW 24-19s-16w, dry, TD 3,745 ft.

Salina County: National Associated 1 Bethany College, NE NE NW 19-16s-3w, dry, TD 3,641 ft.

Sumner County: Wentworth & Smith 1 Steward, SE NE SW 27-30s-1w, dry, TD 3,932 ft.

EASTERN NEBRASKA WILDCAT FAILURE

Harlan County: United Producing Co. 1 D. Asche, NE NE SE 27-3n-17w, dry, TD 4,254 ft.

Southwest Texas

New Carrizo-Wilcox Oil Pool Opened in Atascosa County

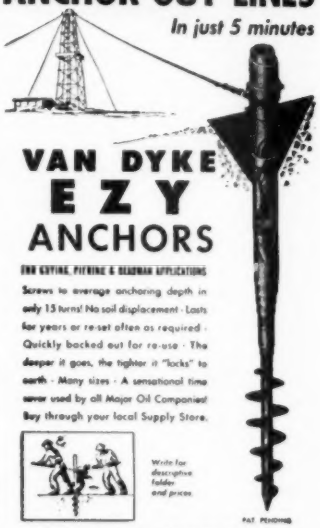
CORPUS CHRISTI.—J. D. Hedley has completed 1 Charles Muil, Atascosa County wildcat, for a new oil pool discovery. From perforations at 2,668-76 ft. in the Carrizo-Wilcox, the well pumped 34 bbl. of 21°-gravity oil per day. Hole is bottomed at 2,768 ft. with 5½-in. production string cemented to 2,692 ft. The new discovery is located in Jorea C. Mattison Survey 467, Abstract 606.

Just south of 1 Muil, B. F. Usery completed 1 Guy Smith from open hole at 2,204½-07 ft. for 129 bbl. of 21°-gravity oil per day on pump. This discovery is located in William Waggoner Survey, Abstract 921, approximately 800 ft. south of 1 Muil. The two wells are producing from different pays, apparently separated by a fault with downthrown side north of the Usery well.

Portilla field, San Patricio County, has been extended to the southeast at Plymouth Oil Co. G-3 R. H. Welder, which also opened a new pay for the area. From perforations at 7,118-23 ft., the well flowed 306 bbl. of 40°-gravity oil daily through 5/32-in. choke. Tubing pressure registered 1,350 psi.

In Cameron County, C. G. Glasscock 1 Mellie Esperson Estate, deep wildcat 12 miles east of Brownsville, has speezed perforations at 13,694-13,704 ft. and reperforated at 13,708-26 ft. No details have been released on the tests.

Delhi Oil Corp. has set pipe and is testing 6 Hagist Ranch, outpost on the southwest flank of Loma Alta-Wilcox field in McMullen County. Hole is bottomed at 7,468 ft., and operator set 5½-in. production string around 7,200 ft. The well tested distillate on drill-stem test at 6,977-79 ft. Another test at 6,809-25 ft. had recovery of distillate. Another test at 6,967-76 ft. recovered distillate. The well reportedly has gas-distillate sand at 6,775-6,826 ft., oil sand at 6,858-70 ft. and 6,880-91 ft., gas-distillate sand at 6,962-90 ft., and gas sand from 7,118-32 ft. Loma-Alta-Wilcox field produces 37°-

How to
ANCHOR GUY LINES
In just 5 minutes

VAN DYKE
EZY
ANCHORS
FOR GUYING, PIPELINE & SEISMOGRAPH APPLICATIONS
Screws to average anchoring depth in only 15 turns! No soil displacement · Lasts for years or re-set often as required · Quickly backed out for re-use · The deeper it goes, the tighter it "locks" to earth · Many sizes · A sensational time saver used by all Major Oil Companies! Buy through your local Supply Store.

Write for descriptive folder and prices
PAT. PENDING
VAN DYKE INDUSTRIES
General Offices
3625 Cahuenga Blvd., Los Angeles 28, California

psst-
want in on a good thing?
You can get quick and dependable service on
ELECTRICAL SUPPLIES
from Nelson Call 5-1241 Tulsa
When it's Electrical
NELSON
ELECTRIC SUPPLY CO.
526 NORTH MAIN • TULSA

gravity oil from two horizons, 6,855-69 ft. and 6,896-6,907 ft. in the Carrizo-Wilcox.

Taylor Refining Co. and Mayfair Minerals have set 5½-in. production string to total depth of 9,974 ft. at 1 Anna Dube, wildcat 1¼ miles northwest of McAllen in Hidalgo County. Operators will probably test a gas sand around 6,300 ft.

SOUTHWEST TEXAS (DISTRICTS 1 AND 4) SUCCESSFUL WILDCATS

San Patricio County: New pay at Portilla—Plymouth Oil Co. G-3 R. H. Welder, E. H. Welder Sur., Sec. 33, TD 8,214 ft., perf. 7,118-23 ft., IP: 305 bbl. oil per day, x-35 choke, TP 1,400 psi., 40.4° gravity.

Starr County: Oil discovery—Geo. E. Wrather Oil Co. and Bass-Vessels 1 Hilaria A. De Garza, Santa Cruz Grant, Tract 7, TD 6,509 ft., perf. 5,941-52 ft., IP: 66 bbl. oil per day, ⅛-in. choke, TP 300 psi., CP 1,350 psi., 45.3° gravity.

SOUTHWEST TEXAS (DISTRICTS 1 AND 4) WILDCAT FAILURES

Bastrop County: Thomas Jourdon, Inc., 1 E. H. Grubert, Thomas J. Gazley Sur., dry, TD 5,108 ft.

Duval County: Dunlap & Corning 2 Duval Co., J. Poitevent Sur., 141, A-393, dry, TD 4,350 ft.

Frio County: Daubert-Achning 1 N. Garcia, S. Edrich Sur., A-288, dry, TD 3,511 ft.

Hidalgo County: Sun Oil Co. 1 Mary O. Shary, San Salvador Del Tule et al. Grant, Jackson Subd., dry, TD 8,502 ft.

Jim Wells County: Jergins Oil Co. of Texas 1 G. A. Parr, Scott-Re-Subd. of Benton Pasture, Sec. 11, Lot 14, dry, TD 6,510 ft.

San Patricio County: R. B. Mitchell 1 I. A. Waters, Block 24, Coleman Fulton Pasture Subd. of Patrick Fitzsimmons Sur., A-5, dry, TD 6,509 ft.

Travis County: J. E. Smith 1 H. M. Haws, J. A. Navarro Sur., dry, TD 1,205 ft.

Wilson County: Hunt Oil Co. 1 L. C. George, Canto Diaz Grant, A-89, Sec. 44, dry, TD 5,855 ft.

Zapata County: W. G. Schimmel et al 1 A. Garza, Sur. 269, Block 13, dry, TD 2,555 ft.

Tri-Mark Oil Co. 1 Marrs McLean, El Javali Grant, Sec. 2, dry, TD 3,005 ft.

Permian Basin

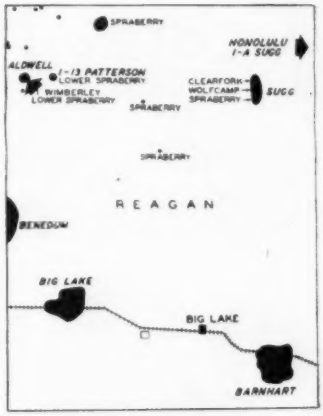
Lower Spraberry Flows In Reagan County Well

MIDLAND.—Adding a bit to the controversy on the ultimate pay-off of the upper Spraberry, this week Paul F. Barnhart 1 Wimberley, discovery well of the Aldwell field of northwest Reagan County, drilled deeper and recompleted as a good flowing well in the lower sand.

This well topped the Spraberry at 6,795 ft., 4,100 ft. subsea. Original completion was for 176 bbl. of oil a day from 6,710-6,900 ft. According to reports, production had declined to around 25 bbl. daily, on the pump. It was drilled ahead to 7,733 ft., to the lower Spraberry and completed for 450 bbl. of oil a day.

Sunray Oil Corp. has schdeuled a test to the lower Spraberry, approximately 1 mile south of present production in the Aldwell field. Location for its 1-17 B. Sherrod was to be made in 17-C-L&SV.

Eight miles farther south, White Eagle Oil Co. 2 Ringo, SE SE 9-D-L&SV, was drilling ahead below 6,637 ft. and going to the lower Spraberry. Tests in the upper Spraberry from 6,470-6,506 ft. developed a flow of 35 bbl. of oil and 20 bbl. of water after Hydrafrac treatment. The 2 Ringo is three locations south, same section, as the 1 Ringo which was drilled dry to 12,056 ft. in 1948.



Spraberry in Sterling Count.—This week attention was turned to Honolulu Oil Corp 1-A Sugg, southwest Sterling County wildcat, which was showing for discovery production, and first Spraberry producer for that county. Location is about 6½ miles northeast of the Sugg area of northeast Reagan County, but just across the line into Sterling County.

Top of the Spraberry in the 1-A Sugg was 5,050 ft., on elevation of 2,600 ft. It was carried ahead to 5,151 ft., and a test made between 5,131-51 ft. Oil came to the surface in 68 minutes and flowed at the rate of 5-7 bbl. an hour. Following that, tubing was run and the well swabbed in, and in 8 hours of flowing, gaged 200 bbl. of oil through ¼-in. choke. Some reports

FASTER PENE-TRATION

FEWER TRIPS

COMPLETE STRATA DATA

Truco DIAMOND BITS

D&S CORE BARRELS

Drilling & Service

3031 Elm Street Dallas 1, Texas

OFFICE PHONE: Riverside-6811

NIGHT NUMBERS: TRemont-5559, Victor-3708, Dixon-4176

Other Offices - Services: Tyler, Texas....2-2742; Odessa, Texas....6-6774; Abilene, Texas....2-2790; Victoria, Texas....3264; Norman, Okla....4360; Shreveport, La....3-5474; Casper, Wyo....3739; Carmi, Ill....7799; Ft. Morgan, Colo....1143; Glendive, Mont....540; Hoisington, Kan....745

Distributors: Diamond Drilling Co., 2759 E. Willow St., Long Beach, Calif., Telephone: Long Beach 40-7949; Allied Services, Inc., Mt. Pleasant, Michigan Telephone: 29-861

Foreign: D. T. O'Connor, 500 Fifth Avenue, New York, N. Y. Petroleum Industry Consultants, C. A., Caracas, Venez. Denton - Spencer Co., Ltd., Calgary, Alberta, Canada.

THE OIL AND GAS JOURNAL

"Oh, it's probably just your arthritis bothering you again!"

FOSTER FLOW TUBE*

SHORT... not long!

The picture above sectionalizes one of our standard 12 inch Foster Flow Tubes. Put a rule on it, lengthwise and diametrically. What do you make the length-diameter ratio? About 1½ to 1?

Yes, 1½ to 1 is about the maximum ratio of length to diameter in the Foster Line of Flow Tubes in sizes 3" and above. Some units have less than a 1 to 1 ratio, particularly when high velocities are encountered. What does this mean to you in the way of installation costs and housing? You can readily picture how easy it is to set the Tube in a line. Just like a section of pipe. And with this compactness is an accuracy which not only equals the accuracy of conventional long primary devices but in most cases exceeds it. This is due to the greater pressure differentials for any given main-to-throat reduction.

Yes, you get great compactness and ease of installation with the Foster Flow Tube. You also can count on satisfactory accuracy. As for your specific applications, write us in detail giving both processing and installation requirements. Standard sizes come in all commercial pipe diameters, flanged or screwed connections. Standard lining is bronze; other metals to order.

*A Proved Flow Tube Added to Foster Line of Regulating Valves

FOSTER ENGINEERING *Company*

835 Lehigh Avenue • Union, N. J.

PRESSURE REGULATORS... RELIEF AND BACK PRESSURE VALVES... CUSHION CHECK VALVES... ALTITUDE VALVES... FAN ENGINE REGULATORS... PUMP GOVERNORS... TEMPERATURE REGULATORS... FLOAT AND LEVER BALANCED VALVES... NON-RETURN VALVES... VACUUM REGULATORS OR BREAKERS... STRAINERS... SIRENS... SAFETY VALVES... FLOW TUBES

indicated most of that amount was load oil. It was shut in for additional storage.

Argo Oil Corp. 1 M. E. Cook, Glasscock County wildcat southwest of Garden City, was swabbing oil after treating with 12,000 gal. of acid in open hole between 7,330-7,510 ft. Twenty-hour hour recoveries were: 100 bbl. of oil plus 6 per cent acid water; 132 bbl. of oil plus 1 per cent acid water; 70 bbl. oil with no water and 50 bbl. of oil with no water in last report.

Murphy & Ashland 1 Marvin L. Couey, southwest Glasscock County wildcat, recovered 80 ft. of drilling mud on a 1-hour test in the Ellenburger at 11,365-390 ft. and operators were coring ahead to 11,415 ft. There have been no shows reported in the Ellenburger, topped at 11,345 ft., minus 8,651 ft.

Sinclair Oil & Gas Co. 1 Henrietta Long, southeast of Garden City, was drilling at 8,829 ft.

Magnolia Petroleum Co. 1 Bryans, 26-35-T4S-T&P, was in lime and shale at 7,930 ft., and Lion Oil Co. 1 Cope, new wildcat in 19-34-T5S-T&P, was spudding in.

WEST TEXAS (DISTRICTS 8 AND 7-C) SUCCESSFUL WILDCAT

Mitchell County: Stanolind Oil & Gas Co. 1 F. A. Langley, 25-29-T1N-T&P, TD 8,180 ft., elev. 2,183 ft., pay 4,210 ft., IP pumped 16 bbl. 29°-gravity oil.

WEST TEXAS (DISTRICTS 8 AND 7-C) WILDCAT FAILURES

Crane County: Humble Oil & Refining Co. 1-D Cowden, 39-X-CCSD&RGNG, dry, TD 9,004 ft., elev. 2,459 ft., estimated. San Andres 3,130 ft., Clear Fork 4,170 ft., Devonian 6,738 ft.

Crockett County: Gulf Stream Oil Co. 7 University Lands, 22-40-University, dry, TD 1,285 ft.

Hockley County: Stanolind Oil & Gas Co. 1-A V. V. Clark, 24-A-R, M. Thompson Sur., dry, TD 10,741 ft., elev. 3,397 ft., San Andres 3,700 ft., Wolfcamp 7,840 ft., Strawn 10,031 ft.

Howard County: Christman, Welborn-Saltmount Oil Co. and Peeler Bros. 1 Wm. Bogie, 66-20-Lavaca Navigation Co. Sur., dry, TD 7,705 ft., elev. 2,282 ft., reef 7,441 ft.

Kerr-McGee Oil Industries, Inc. 1 Binie, 24-25-H&TC, dry, TD 8,000 ft., elev. 2,446 ft., Spraberry 5,088 ft., reef 7,645 ft., Strawn 7,971 ft.

Hudspeth County: J. P. Hurndall J. C. Reed, 17-45½-PSL, dry, TD 705 ft.

Pecos County: George T. Abell 1 Sloan Blair, 35-10-H&GN, dry, TD 2,727 ft.

British American Oil Co. 1 John McDonald, 4-F-TCRR, dry, TD 5,504 ft., elev. 2,488 ft., Wolfcamp 4,738 ft., Ellenburger 5,280 ft.

Reagan County: Parker Drilling Co. 1 Lucy R. Wayle, 1,205-C-GC&SF, dry, TD 7,130 ft.

Runnels County: G. W. Strake 4 M. L. Stubblefield, Wm. Wooderson Sur. 477, dry, TD 5,488 ft.

Terry County: Davidson Drilling Co. 1 J. M. Robertson, 11-C37-PSL, dry, TD 5,018 ft.

Tom Green County: Seaboard Oil Co. of Delaware 1 R. T. Neill, P. Worth Sur. 639, dry, TD 6,880 ft., elev. 2,135 ft., Ellenburger 6,798 ft.

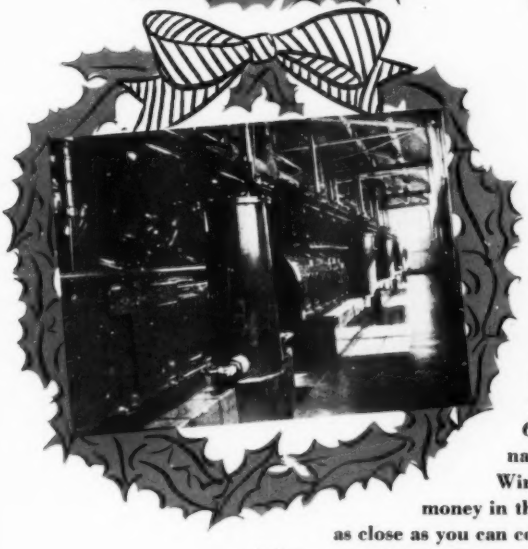
TEXAS PANHANDLE

AMARILLO.—Three outpost wells along the southern fringe of Panhandle field production have opened up new gas reserves in recent testing operations.

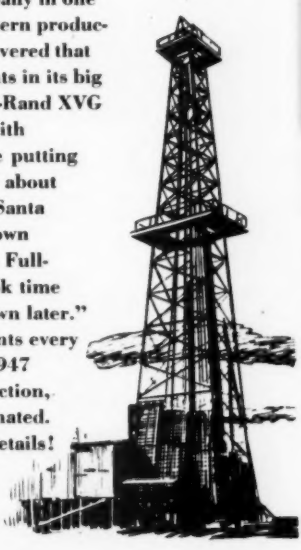
In Gray County two wells 11 miles apart are waiting on Railroad Commission test after production tests indicated more than 1 million cubic feet daily gas production from each. A third well in Collingsworth County has tested nearly ½ million cubic feet of gas and is waiting on test.

A company gage taken on the Phillips 1 Johnson "R" in Gray County showed 3,680,000 cu. ft. of gas daily from Permian dolomite at 2,660-2,713 ft. The well is a 1-mile southeast stepout to production in the Wheat area discovered by Phillips this year. The other Gray County well, located 4 miles from nearest gas production, is the T. J. Wagner, Jr. 1 Goldston, which had a company test of 2,800,000 cu. ft. daily.

Every day can be Xmas when you cut your costs



A major oil company in one of the largest western producing fields has discovered that protecting lubricants in its big 6-cylinder Ingersoll-Rand XVG natural gas engines with Winslow Filters is like putting money in the bank. And that's about as close as you can come to having old Santa visit you every day of the year. The five engines shown above, which are used for re-cycling gas, were first equipped with Winslow Full-Flow filtration back in 1947, and, as one of the engineers observes, "It took time to *show* the results. Visually, oil looks clean, but engine protection is shown later." Running 24 hours a day, using a straight mineral oil and changing elements every 2700 hours, the engine operators have never changed the oil since that 1947 installation! The 12-month major overhaul has become just a major inspection, with bearing replacements and intermediate time and material costs eliminated. Why not give *your* engines this kind of a Christmas present? Write for details!



WINSLOW FILTERS

Winslow Engineering Company 4069 Hollis Street • Oakland 8, California

When You Need Efficiency in Swabbing

You Can Depend on Bell Swabs

Whether swabbing

. . . oil

. . . water

. . . or mud . . .

you can depend on BELL'S DESIGN and QUALITY for

MAXIMUM RECOVERY

BELL RUBBER COMPANY

- **Phone EDgemont 2-1281**
- **6001 W. Jefferson**
- **P. O. Box 4426**
- **DALLAS 11, TEXAS**

Bottom depth of this well is 2,383 ft. in Permian dolomite.

The Collingsworth County test, Oil Associates 1 Hobbs, had an estimated 400,000 cu. ft. of gas from dolomite topped at 1,720 ft. Location is at the extreme southeastern edge of the field, 4 miles from closest production. Pay zone is 1,779-1,801 ft.

In a Childress County wildcat formations containing good fluorescence and a slight gas show were proved to be unproductive after a drill-stem test. A 1½-hour test taken on Blanco Oil Co. and Al Buchanan 1 Russell recovered 1,000 ft. of salt water from 2,780-2,800 ft. Flow pressure was 120 psi. and shut-in bottom-hole pressure 1,130 psi.

Drilling operations have recommenced on Kerr - McGee 1 Berneta, Hartley County shallow wildcat, after bail tests recovered only salt water. Hourly recovery was 26 to 30 bbl. of salt water after acidization of dolomite showing oil from 3,672-76 and 3,714-16 ft. The well is currently being drilled ahead below 3,850 ft.

An old wildcat drilled deeper in Hale County, Standard of Texas 1 Joe Kelliehor, has been completed dry at a total depth of 10,805 ft. Drill-stem tests recovered oil and oil and gas-cut mud from 8,510-40 and 8,702-30 ft. in Pennsylvania, but production was not commercial.

TEXAS PANHANDLE (DISTRICT 10) WILDCAT FAILURE

Briscoe County: H. L. Hunt 3 Ritchie, 38-G6-A&G, 19 mi. NE Silverton, dry, TD 6,737 ft., elev. 2,340 ft.

SOUTHEASTERN NEW MEXICO

HOBBS—Jackson, Douglas & Ritchie 1 State, Lea County wildcat northwest of Bagley field in 27-10s-32e, did not flow but developed clean oil on drill-stem tests in the Permo-Pennsylvanian.

First test from 8,198-8,244 ft., open 4 hours, recovered 100 ft. of oil and gas-cut mud estimated to be 75 per cent oil. From 8,339-8,410 ft., gas showed in 27 minutes, followed by a spray of oil, and recovery was 100 ft. of slightly oil and gas-cut mud, plus 943 ft. of mud-cut oil. Last reported test from 8,387-8,438 ft., open 5 hours, had gas in 16 minutes and recovered 100 ft. of clean 45°-gravity oil, plus 1,100 ft. of clean and mud-cut oil. Bottom-hole flowing pressure was 250 psi.

Magnolia Petroleum Co. 1 Black, 9-15e-36e, which had been testing for several weeks, completed for 156 bbl. of oil a day from the Pennsylvanian.

Northwest of Lovington, Wilshire Oil Co. 1 Townsend was drilling ahead at 11,736 ft. Last reported drill-stem test, from 11,470-532 ft., had gas to the surface in 42 minutes and recovered 3,450 ft. of clean oil, which unloaded by heads, plus 550 ft. of oil in the pipe.

SOUTHEAST NEW MEXICO WILDCAT FAILURES

Lea County: Carper Drilling Co. 1 Emery-State, 28-17s-36e, dry, TD 5,181 ft., elev. 3,859 ft., Queen 4,309 ft., San Andres 5,094 ft.

Skelly Oil Co. 1 Mexico State-M, 9-24s-38e, dry, TD 10,073 ft., elev. 3,236 ft., Glorietta 3,610 ft., Wichita 7,140 ft., Mississippian 8,610 ft., Woodford 9,140 ft., Devonian 9,610 ft.

Mississippi

Gulf's First Mobile Bay Test Recovers No Shows

JACKSON.—Top of fish has been found at 2,624 ft. in Monroe County's prospective discovery, Union Producing Co. 1 Sanders (was formerly Northeast Mississippi Oil Co.). Attempts to establish circulation failed, and operator pumped 570 bbl. of mud into the hole, but the well kicked. The well was flowing under 1,140 psi. pressure, and it was impossible to kill it. Union now plans to use 1½-in. pipe and clean out inside the 3½-in. drill pipe to establish circulation after perforating the drill pipe. If successful, then sufficient mud can be pumped into the well to kill it and recover the 3½-in. drill pipe. Then the hole will be cleaned out to total depth of 6,060 ft., casing set and perforated back up the hole in an effort to locate the gas reservoir from which the well is producing.

Lion Oil Co. 2 Denkmann, Smackover wildcat in Rankin County, has set 7-in. casing at 15,090 ft. Operator plans to core ahead when operations are resumed on the venture. Slight show of gas encountered in core at 15,102-17 ft.

Potential test has been run on the first Sparta sand producer for the state of Mississippi, Austin E. Stewart 1 F. M. McGehee, 41-8n-1w, Adams County. Through ¼-in. choke, the well flowed 1,612,000 cu. ft. of gas daily from perforations at 3,001-03 ft. Tubing pressure registered 1,082 psi. The well had a calculated open-flow potential of 14,250,000 cu. ft. daily.

Barnett Serio Drilling Co.-Gulmon & Johns have completed 1 Ligon & Mazique, 20-5n-32, Adams County, for 217 bbl. of oil per day through 10/64-in. choke. Production is from the Parker zone at 6,412-15 ft. This well is located on the northwest flank of Sibley field.

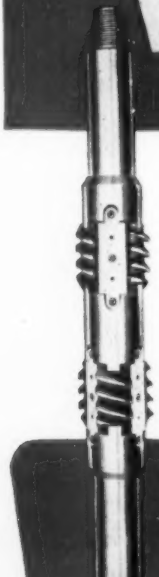
Alabama.—Gulf Refining Co. has plugged its first venture in Mobile Bay, at total depth of 10,026 ft. with no shows of oil or gas being encountered. The company is still drilling 2 State of Alabama "D," its second offshore operation. Gulf is the first major company to drill in waters fronting the State of Alabama.

MISSISSIPPI SUCCESSFUL WILDCATS

Adams County: New pay at Sibley—B. Serio Drilling Co.-Gulmon & Johns 1 Ligon & Mazique, 20-5n-3w, TD 6,730 ft., Parker 6,412-15 ft., IP: 217 bbl. oil per day, 10/64-in. choke, 41.8° gravity.

Gas discovery: Austin E. Stewart 1 F. M.

HOW IS THE "WORKING SURFACE" —the Vital I. D. of your Casing?



YOU CAN SAFELY, easily and economically remove burrs from gunshot holes, imbedded bullets, or sheaths of cement or hardened mud from the inner wall of casing. ★ No more cut and torn rubber swab cups, or rubber packing elements on testers, packers and cement retainers. ★ The strong, safe Baker ROTO-VERT Casing Scraper has two sets of deeply hard-faced blades which shear away all obstructions and overlap to scrape the full 360-degree inner surface of casing. ★ Cannot "screw down" past gunshot burrs because the cutting edges follow the contour of a LEFT-HAND screw. ★ Specify the ROTO-VERT when there are hundreds of burrs to be removed, or the well is to be scraped from top to bottom. ★ You can still use time-tested Baker Model "B" Casing Scraper, Product No. 620-B, for normal scraping when rotary equipment is available.

Your casing really "comes clean" when you use the successful BAKER ROTO-VERT Model "C" Casing Scraper

BAKER OIL TOOLS, INC.
HOUSTON • LOS ANGELES • NEW YORK

McGehee, 41-8n-1w, TD 6,515 ft., Sparta 3,001-03 ft., IP: 1,612,000 cu. ft. of gas per day, ¼-in. choke, TP 1,082 psi.

MISSISSIPPI WILDCAT FAILURES

Choctaw County: Henson-Rife Co. 1 W. J. & T. W. Green, 10-17n-9e, dry, TD 4,617 ft.

Holmes County: George A. Miller 1 Presley, 11-12n-3e, dry, TD 10,810 ft.

Jefferson County: J. Willis Hughes 1 W. J. Colbert et al, 29-8n-1e, dry, TD 6,505 ft.

Lamar County: Plains Production Co. 1 Hibernia Bank & Trust Co., 13-2n-16w, dry, TD 5,864 ft.

Scott County: L. Cashion Co.-Don Reese 1 L. E. Tadlock, 26-7n-7e, dry, TD 6,570 ft.

Sharkey County: Tide Water Associated Oil Co. 2 Panther-Burn Co., 9-14n-6w, dry, TD 3,764 ft.

ALABAMA WILDCAT FAILURE

Mobile County: Gulf Refining Co. 1 State of Alabama "D," located in Mobile Bay, dry, TD 10,020 ft.

Appalachian-Ohio

Small Gas Well Finaled in Garrett County, Maryland

PITTSBURGH.—In Garrett County, Maryland, Eberly & Snee completed 2 Gordon, elevation 2,486 ft., with gas gaging 175,000 cu. ft. Chert 3,811 ft., show gas at 3,838 ft., Oriskany sand 3,931 ft., gas 3,934-3,939 ft., total depth 4,082 ft. Location has been made for 3 Gordon. In their 2 Eli Beechie, elevation 2,456 ft., drilling is at 4,216 ft., chert 4,052 ft., and Oriskany sand 4,174 ft.

Cumberland & Allegheny Gas Co. 1 C. C. Mason, elevation 2,427 ft., topped the chert at 3,729 ft., and is drilling at 3,740 ft.

Delaware Gas Co. 1 George Perrine, elevation 2,420 ft., is drilling at 3,758 ft., chert 3,711 ft., show gas 3,735 ft., Clarksburg Gas Co. 1 T. W. Ashby, elevation 2,391 ft., had a very slight additional show of gas at 3,719 ft. in the Oriskany sand.

Elk district, Kanawha County, West Virginia, United Fuel Gas Co. 19-6790 S. B. Bare was completed as a dry hole, Cornferous lime 5,133 ft., Oriskany sand 5,254 ft., show of gas and salt water 5,265 ft., total depth 5,265 ft. Big Creek district, McDowell County, Godfrey L. Cabot, Inc. 50-1351 resulted in 1,400,000 cu. ft. gas, Berea sand. Kermit district, Mingo County, United Fuel Gas Co. 6755 Burning Creek Maribone Land Co., 1,154,000 cu. ft. gas, Big Injun sand, total depth 2,095 ft. Triadelphia district, Logan County, United Producing Co., Inc. 8-1901 Buffalo Creek Coal & Coke Co. gaged 1,107,000 cu. ft. gas, Berea sand, total depth 3,550 ft.

Napier Township, Bedford County, Southwest Pennsylvania, South Penn et al-Snee & Eberly 1 Jesse B. Miller is bailing water at 8,979 ft. Unity Township, Westmoreland County, Peoples Natural Gas Co. 1-4003 A. J. Dotterway, elevation 2,094 ft., 3,449 ft., shut down.

MARYLAND SUCCESSFUL WILDCAT

Garrett County: Eberly & Snee 2 Gordon 175,000 cu. ft. gas, chert 3,811 ft., show gas 3,838 ft., Oriskany sand 3,931 ft., gas 3,934-3,939 ft., TD 4,032 ft.

OHIO

Indications of a new gas pool 3 miles from production has been found in Cass Township, Muskingum County. Mutual Oil & Gas 1 John Scarpellini, Lot 16, fourth quadrangle, logged Clinton sand at 3,620-60

Positive Seal Under Toughest Conditions
Stop worrying about leaky stuffing boxes. Install Kinzbach Polished Rod Stuffing Boxes on your pumpers and your worries are ended. They are plastic packed with a floating, self aligning gland and hold positive seals under the toughest conditions. Unique design permits plastic to be added as required or seal to be tightened at any time without shutting down the well. Available for all popular sizes of polished rods.
KINZBACH TOOL CO., Inc.
P. O. BOX 277 • HOUSTON, TEXAS
EXPORT OFFICE:
74 Trinity Place,
New York, N. Y.
KINZBACH
TOOL
CO
INC

meet the new member of the family

model 21-401 mass spectrometer

an analytical and isotope-ratio mass spectrometer combined

CONSOLIDATED's new Model 21-401 Mass Spectrometer is a compact, medium-priced instrument, ideal for those laboratories having only moderate analytical loads. Highly versatile, it provides not only quantitative analyses of gaseous or light-liquid mixtures as automatically recorded mass spectra, but *also* precise *recorded* ratios of stable gaseous isotopes. Like the widely used Model 21-103, it is exceptionally accurate and incorporates many automatic, time-saving features. For the multitude of industrial and scientific applications not requiring extremes of mass range, sensitivity, and operating speed, the Model 21-401 is of maximum value. Further information is contained in Bulletin CEC-1821-X3.

The widely used Model 21-103 Mass Spectrometer for broad applications - analytical and research.

Model 21-201 Isotope-Ratio Mass Spectrometer - specifically for measuring ratios of stable isotopes in gases.

CONSOLIDATED ENGINEERING
Corporation

Analytical Instruments CEC *for Science and Industry*
300 No. Sierra Madre Villa, Pasadena 8, California

ft. with a gage of 600,000 cu. ft. of gas natural. Pay was at 3,640-57 ft. and the well was tubed without shooting.

One of the best wells yet found in Jackson Township, Knox County, was completed by Wray Drilling Co. on 1 Lee Dugan in Section 18, Clinton at 2,995-3,020 ft. made 55 bbl. of oil natural and 300 bbl. in 18 hours after a 120-qt. shot.

Berea sand pool in Washington Township, Tuscarawas County, was extended ⅛ mile to the northeast by the Mid Atlantic Oil & Gas 1 Fred Maurer, in Lot 41. Sand at 992-1,007 ft. gaged 640,000 cu. ft. of gas natural.

In the shallow field in Washington County, Bob Braden 1 George Lane, Section 6, Warren Township, topped the Injun sand at 1,580 ft. After drilling 2 ft. into the sand, the well gaged 1,250,000 cu. ft. of gas natural.

Ohio Fuel Oil Co. 1 Ralph Conner, Section 37, Ripley Township, Holmes County, drilled lower Clinton at 3,123-35 ft. with an open flow of 2,650,000 cu. ft. of gas natural.

Rocky Mountain

Montana, North Dakota Tests Near Completion

DENVER.—Winter weather has slowed operations in the Williston basin, but two wells are near completion this week. The Texas Co. has lost line and swab in 1 Northern Pacific "B," C NE NE 35-15n-54e, at Cedar Creek, Dawson County, Montana, after displacing mud with oil for completion. The well flowed 195 bbl. of 39°-gravity oil through tubing and junk in 23 hours and apparently will be an excellent discovery in this area. Casing is cemented at 8,745 ft. with total depth at 9,079 ft. and more than 220 ft. of producing section. Devonian was topped at 8,542 ft. and the company has not announced whether production is from that formation or from Ordovician.

On the North Dakota side of the basin Amerada Petroleum Corp. is testing Madison at 1 Iverson, C SW SW 6-155n-95w, Williams County, the first commercial producer in the basin. This well was completed earlier this year producing from Devonian and has been plugged back to Madison and will be the first producer completed in that formation in the basin. Amerada has been testing the well through various-sized chokes following 2,000-gal. acid treatment of the zone 8,520-28 ft. The oil is 37.8° gravity. In 24 hours the well flowed 638 bbl. of oil with 849,515 cu. ft. of gas on 15/64-in. choke with 1,650 psi. tubing pressure. Amerada is now pulling tubing to check for leaks prior to additional testing.

The company's second well at Beaver Lodge also logged Madison production, as did its 1 Bakken, C SW NW 12-15n-95w, 10 miles north of Beaver Lodge in the Tioga area. At 1 Bakken Amerada is now milling on junk with the well at 11,588 ft., total depth. Amerada has announced location for 1 Reitsch-Iverson, C NE SE 1-155n-96w, a new well in the Beaver Lodge area, and is now drilling a total of seven wells along the general Nesson anticline through this area.

Madison was topped at 6,960 ft. at the Stanolind Oil & Gas Co.-Continental Oil Co. discovery well in the North Fork area, Johnson County, Wyoming. The operator has reported no shows in that formation to the present drilling depth of 7,135 ft. The well sprayed oil on tests of the Tensleep, and casing has been cemented on top of that formation at 6,484 ft. More than 200 ft. of Tensleep section was tested, indicating a substantial reserve in that formation for this area. The wildcat is northwest of the Sussex-Meadow Creek pools, where Tensleep oil has also been developed.

Sinclair Oil & Gas Co.'s East Salt Creek wildcat, Wyoming, is a completion this week with the well flowing 48 bbl. of oil

HERE'S

Yuletide Greetings

FOR YOU AND YOURS . . . . .

From 22 Bovaird Offices and Stores

THE Bovaird SUPPLY COMPANY

GENERAL OFFICES
TULSA, OKLAHOMA

80 YEARS OF PROGRESS WITH THE OIL INDUSTRY

IN A CLASS BY ITSELF...

COMPLETELY DRILLABLE
You will never have to "mill up" a Baker Retainer Production Packer.

NO "SET-DOWN" WEIGHT REQUIRED
When desired the tubing can be suspended in tension to avoid "corkscrewing."

RESISTS CORROSION
Cast iron construction of the packer is more corrosion resistant than steel casing.

HOLDS BOTH WAYS
Two full sets of opposing slips prevent downward or upward movement of packer.

CLEAR PASSAGE THRU PACKER
for "down-hole" work. Flapper type back-pressure valve opens readily and closes positively.

MANY APPLICATIONS
including two-zone, single-zone, testing, acidizing, re-pressuring, gas lift, etc., are possible with . . .

PACKER IS FREE FROM TUBING
and is practically part of casing. Vertical movement of tubing is unrestricted.

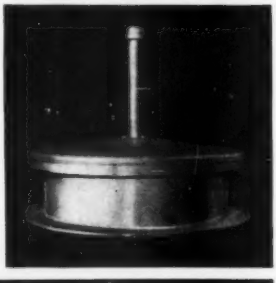
EFFICIENT ACCESSORY EQUIPMENT
as described and illustrated in the BAKER CATALOG and the Composite Catalog.

Product No. 415-D

BAKER

RETAINER PRODUCTION PACKER

OCECO
Emergency
pressure relief
Vents



prevent explosions

These units provide additional venting capacity beyond the breather vent, and give instant relief from excessive internal pressures resulting from exposure fires, etc., preventing tank blow-ups and explosions.

Required by many state fire codes. Recommended by both the N. F. P. A. and A. P. I.

The V-108 with cast aluminum cover, pictured at the top, furnished in 6", 8" and 10" sizes; V-108-A with fabricated aluminum cover, pictured below, furnished in 15¼" and 20½" sizes. *Write for full details today.*

OCECO TANK FITTINGS
THE JOHNSTON & JENNINGS CO.
division of PETTIBONE MULLIKEN CORP.
4751 West Division St. • Chicago 51, Illinois

from Second Wall Creek and 202 bbl. of oil from the Lakota on swab. Sinclair has reported that the well adds an important reserve for the region this year. Offsets have been started and better completions from the Second Wall Creek are expected from the area.

There were 17 completions of wildcat wells this week with 5 in Wyoming, 6 in Colorado, 2 each in Montana and western Nebraska, and 1 each in northern New Mexico and South Dakota.

Ohio Oil Co. completed a new gas discovery for the Denver-Julesburg basin in the West Big Springs area, Deuel County. The discovery flowed 2,250,000 cu. ft. of gas daily, and a second well completed this week flowed 4,000,000 cu. ft. daily with both D sand completions. J. B. Stoddard, Dallas, independent, has operating interests with Ohio in this area.

After failing to overcome lost-circulation difficulties at Willow Creek, Utah, Carter Oil Co. has run casing and will test Mesaverde at 1 Unit, C NE SW 21-11s-21e, Uintah County. The well is of interest as the first to have oil on tests of the Mesaverde in this area. Total depth is 8,320 ft., and casing was cemented at 8,317 ft., through the zone where oil was tested at 8,176-95 ft. There is one commercial Mesaverde gas-producing well in the Uintah basin, but no other wells have been completed in that formation, and Carter is expected to make thorough tests of the formation prior to completion of the well.

COLORADO WILDCAT SUCCESS

Weld County, Greasewood area: Gifford Parker and J. G. Dyer 2 Kirchoff, C SE NW 12-6n-61w; TD 6,780 ft., IP: flowed 27 bbl. oil per hour. Hygiene 3,218 ft., Niobrara 6,025 ft., Ft. Hays 6,308 ft., Codell 6,340 ft., "D" sand 6,738 ft.

COLORADO WILDCAT FAILURES

Crowley County, Ordway: Colorado Fuel & Iron Corp. 1-A State, SW SW NE 36-18s-56w; TD 4,710 ft., dry. Pennsylvanian 4,633 ft.

Logan County: J. & L. Drilling Co. 1 Gaines, C SW SW 35-8n-53w; TD 4,790 ft.; dry. Niobrara 3,703 ft., Timpas 4,055 ft., Carlile 4,120 ft., Greenhorn 4,325 ft., "D" sand 4,572 ft., "J" sand 4,665 ft.

Phillips County: Sunray Oil Co. 1 Hotaling, C NE SW 27-9n-43w; TD 4,977 ft.; abandoned. Niobrara 2,427 ft., Greenhorn 2,973 ft., "D" sand 3,178 ft., "J" sand 3,267 ft., "M" sand 3,486 ft., Morrison 3,784 ft.

Washington County: Fisher & Stout (Gem Oil Co.) 1 Donnelly, SW SW SE 28-4s-51w; TD 4,365 ft.; dry. Niobrara 2,900 ft., Ft. Hays 3,390 ft., Greenhorn 3,560 ft., "D" sand 3,850 ft., "J" sand 3,908 ft. Fuson 4,108 ft., Lakota 4,211 ft., Morrison 4,300 ft.

Yuma County: Jack Manning 1 Ed Henik, NW NW SE 8-1n-48w; TD 6,768 ft., dry. Niobrara 2,746 ft., Timpas 3,213 ft., Greenhorn 3,435 ft., "D" sand 3,656 ft., "J" sand 3,744 ft., Cloverly 3,978 ft., Red Beds 4,415 ft., lime 5,100 ft., granite wash 6,700 ft., granite 6,765 ft.

WYOMING WILDCAT SUCCESS

Natrona County, East Salt Creek: Sinclair Oil & Gas Co. 1 East Salt Creek, SE SE SW 10-40n-78w; TD 6,001 ft., flowed 48 bbl. 37°-gravity oil in 24 hours from second Wall Creek, 202 bbl. oil per day from Lakota (dual completion); Teapot 480 ft., Parkman 840 ft., Steele 1,435 ft., Sussex 2,020 ft., Shannon 2,448 ft., base Shannon 2,585 ft., Niobrara 3,898 ft., first Wall Creek 4,533 ft., second Wall Creek 4,903 ft., Muddy 5,662 ft., Dakota 5,823 ft., Lakota 5,904 ft., Morrison 5,968 ft.

WYOMING WILDCAT FAILURES

Big Horn County, East Sage Creek: Sunray Oil Co. 1 Crume, C NE SE 9-57n-97w; TD 4,109 ft., dry; Gypsum Springs 2,907 ft., Chugwater 2,990 ft., Dinwoodw 3,430 ft., Tensleep 3,472 ft., Amsden 3,658 ft., Madison 3,830 ft.

Fremont County: Logan Gulch: Far West-American Republics Corp. and John F Camp & Son 1 Govt., NE NW NW 35-

We Join Hands -

MARINE EXPLORATION COMPANY
HOUSTON · NEW ORLEANS

Merry Christmas

from Jarring Jerry and all the Johnston gang

33n-93w; TD 5,059 ft., dry; Muddy 2,200 ft., Sundance 2,865 ft., Nugget 3,088 ft., Chugwater 3,448 ft., Alcova 3,727 ft., Dinwoody 4,517 ft., Phosphoria 4,625 ft., Tensleep 4,966 ft.

Natrona County, Wilson dome: Frank Morgan 1 McCarthy, SW SE NW 5-37n-83w; TD 3,605 ft., dry; first Frontier 110 ft., third Frontier 715 ft., Mowry 950 ft., Lakota 1,575 ft., Morrison 1,620 ft., Sundance 1,850 ft., Alcova 2,300 ft., Embar 2,980 ft., Tensleep 3,382 ft.

Park County: NW Hart Mountain: Husky Oil Co. 1 Hilltop, C NW NE 35-55n-103w; TD 2,692 ft., dry; Frontier 990 ft., Mowry 1,390 ft., Dakota 2,420 ft., Fuson 2,610 ft., Lakota 2,640 ft., Morrison 2,660 ft.

MONTANA WILDCAT FAILURES

Fallin County, Baker: Monoco 1 Baker, NW SW SE 12-7n-60e, TD 2,012 ft.; standing, dropped until operations resume; sand 1,889 ft.

Madison County: Twin Bridges: Ruby Oil

(Continued on page 416)

Louisiana-Arkansas

New Pay Indicated At Shreveport Pool

SHREVEPORT.—Houston Oil Co. of Texas 11 Ellerbe in Shreveport field of Caddo Parish recovered 25 ft. of oil with no indication of formation water on a drill-stem test of the Travis Peak sand at 6,222-38 ft. which flowed gas with a working pressure of 1,425 psi. in 12 hours.

This possible new pay discovery, 1,990 ft. from the south line and 1,997 ft. from the east line of 27-18n-14w, is in an old dry hole drilled to 6,690 ft. back in 1941. Houston Oil deepened the hole to 9,091 ft. only to find the Cotton Valley sands without oil in commercial quantities and plugged back for Travis Peak test on the basis of shows of oil in sidewall samples.

Arkansas.—A northwest offset to the discovery well of North Fouke field, Miller County, has been completed for 51 bbl. daily on pump. The well, Skelly Oil Co. 1 M. G. Purifoy, SE SE NE 19-16s-26w, is producing from the Tuscaloosa sand at 3,334-40 ft. North Fouke was opened by Skelly 1 Philyaw, NW NW SW 20-16s-26w, which found oil in the Paluxy sand at 3,554-60 ft. In the recently completed offset the Paluxy was found noncommercial.

LOUISIANA WILDCAT SUCCESS

Concordia Parish: Barnett Serio 1 Wilds, SW SW 7-7n-7e, pumped 20 bbl. 39.8°-gravity oil plus 10 bbl. water from Wilcox at 5,131-32 ft., TD 5,510 ft., Tentative name of new discovery: Athlone.

LOUISIANA WILDCAT FAILURES

Bossier Parish: Stanolind Oil & Gas Co. 1 O. L. Bredenharn, W/2 SW NW 22-21n-14w, dry, TD 2,843 ft.

DeSoto Parish: Caddo Oil Co. 1 J. M. Jones, NW SE SW 7-12n-12w, dry, TD 2,671 ft.

Gibson Drilling Co. et al 1 K. P. McDonnell, 312 ft. N and 227 ft. E SWc NW SW 3-10n-12w, dry, TD 3,305 ft.

Tensas Parish: Magnolia Petroleum Co. 1 N. Gessner, from intersection of E line of Palmyra Lake go S 66° 30' W 938 ft. to location in 11-13n-13e, dry, TD 2,671 ft.

ARKANSAS WILDCAT FAILURES

Ouachita County: Hunt Oil Co. 1 H. L. and Leo Berg, 100 ft. SE C SW SW 33-14s-17w, dry, TD 3,410 ft. Hogg sand 2,630-95 ft.

Burnett Producing Co. 1 R. O. Alley "A," 100 ft. N C SW NE NE 36-14s-19w, dry, TD 3,022 ft. Travis Peak 2,740 ft.

Jack Carnes 1 Southern Co., SW SW 28-14s-16w, dry, TD 2,723 ft.

Clark County: Ed Ren Oil Co. 1 Ester C. Ross, SE SE SW 34-9s-21w, dry, TD 944 ft.

What do you need in air foam?

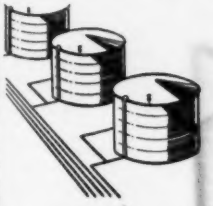
PYRENE* makes a full line of equipment

Air foam kills gasoline, oil and other flammable liquid fires quickly and is the surest safeguard against re-flash. Pyrene Air Foam offers important advantages. It is simple—one man can operate most installations. It is flexible—equipment can discharge either water or foam, can be stationary or portable. It is economical—sparing in use of both water and foam compound. You get about 200 gals. of foam from one gal. of Pyrene Foam Compound and 20 gals. of water.

Whatever the size or nature of your hazard, Pyrene can provide your most effective, most economical protection. For Pyrene makes *a complete line of air foam equipment!*

PYRENE FOAM PLAYPIPES

Portable; easy to carry and use. Make foam anywhere that hose and water connection are available! Five sizes, capacities 200 to 1,600 gals. foam per min.



PYRENE FOAM SYSTEMS

Four different types, to meet every need. Whatever your problem, there's a Pyrene Foam System to solve it.

PYRENE FOAM COMPOUND

One gal. of foam compound and 20 gals. of water yield 200 gals. of foam!

PYRENE PORTABLE AIR FOAM TOWER

Light, compact, adjustable unit is easily erected in a few minutes. Delivers 2,000 to 3,000 gals. foam per min. to tops of storage tanks without fixed foam inlets.

FREE! *Send for complete data on Pyrene Air Foam and Equipment—listed by Underwriters' Laboratories and Factory Mutuals.*

Pyrene Air Foam

*T.M. Reg. U.S. Pat. Off.

PYRENE MANUFACTURING COMPANY

579 Belmont Avenue Newark 8, New Jersey

Affiliated with C-O-Two Fire Equipment Co.

The Pyrene Manufacturing Co. of Canada, Ltd.
91 E. Don Roadway, Toronto

The Pyrene Company, Ltd.: 9 Grosvenor Gardens, London, S.W. 1

For engineering sales and service, contact the Company or either of the following: Stentz Equipment Co., P. O. Box 3367, Tulsa; 3036 Maplewood, Dallas; 1213 Capitol, Houston • Horn Fire Equipment Co., 4917 Sheila, Los Angeles.

Canadian Fields

Discovery Indications At Four Wildcats

CALGARY.—Four exploratory wells in Alberta brought discovery or indications of discovery during the second week of December.

One of the more significant strikes was made at a wildcat in the Bonnie Glen area, about 6½ miles south of D3 Devonian oil wells at Wizard Lake. This venture discovered "wet gas" in D3 Devonian zone, and at last report was drill-stem testing a lower section in D3 in the hope that an oil column is present.

A wildcat in the Coutts area of southern Alberta, just north of the Montana border, gave oil encouragement in the Lower Cretaceous sand. About 2 miles southeast of previous Campbell area production, an Alberta team of independent oil companies found Cretaceous gas and oil. In the Chancellor area of southern Alberta, a Calgary team of independents found a large flow of natural gas plus some naphtha.

Texaco Exploration Co. 1-A Bonnie Glen indicated first signs of discovery when drilling bit entered a highly porous D3 section at a favorable elevation. A protective string of casing was set in top of D3, and drill-stem tests in the top 75 ft. of that zone, between 6,382 and 6,457 ft. gave substantial natural gas flow rates plus distillate. Hole has now been cored to 6,510 ft., 128 ft. below top of D3, and drill-stem testing is currently under way.

The 1-A Bonnie Glen discovered natural gas in the Viking sand horizon, but found both the Lower Cretaceous and D2 zone of Devonian unproductive.

The well is located in LSD 3, 20-47-27w4, on a 320-acre tract that is owned 50-50 by Texaco Exploration and McColl-Frontenac Oil Co.

The southern Alberta oil strike at Coutts is in an area where exploratory operations have increased considerably during the past few months. The encouraging oil show was obtained at a venture being drilled by the team of Rio Tinto, Alberta Oils, Ltd., and Punch Petroleums, Ltd. First oil showed during a 1-hour drill-stem test in the Moulton member of the Lower Cretaceous sand interval 2,590 to 2,623 ft. This test gave up 120 ft. of gassified oil-cut mud and 210 ft. of gassified light, greenish-brown oil. It is not as yet possible to determine whether this oil find will be commercially productive. Coring and testing is being continued.

The team's Coutts area well is Rio Tinto-Punch 1 Red Coulee, in LSD 10, 6-1-16w4, 7 miles west of the border town of Coutts and 55 miles southeast of Lethbridge. Site is about ¾ mile north of the Montana border, and about 3 miles north of Darling oil pool in that state.

The East Campbell gas and oil strike was made by the Alberta team of Decalta Oils, Ltd., and Halcro Oils, Ltd. The find was made in the Cretaceous at Decalta 1 Halcro, in LSD 1, 30-54-24w4, 2 miles southeast of Wagner area Campbell wells. The gas came at 3,665-93 ft., at rates up to 2,724,000 cu. ft. daily. An indicated 13½ ft. of Cretaceous oil pay zone was encountered, between 3,694 and 3,707½ ft., with oil recoveries during drill-stem tests in that section ranging from 585 ft. to 1,080 ft. Tests below 3,707½ ft. gave salt water. Crew is continuing to core and test in the Cretaceous.

At Chancellor, about 48 miles east of Calgary, a five-company team of Calgary oil firms discovered natural gas and some naphtha on farmout lands from Socony-Vacuum Exploration Co. This strike was made in the Sunburst sand section, and company officials believe that between 20 and 22 ft. of good gas section was encountered from top of the sand at 4,706 ft. Natural gas flow rates ranged from 3,700,000 to 5,500,000 cu. ft. daily during drill-stem tests, and 1-hour recoveries of several feet of naphtha or light oil. Latest test, at 4,739 ft. and in a tight sand section, gave only gassified drilling mud. No water has as yet shown during tests. Coring will be continued through this sand, and if warranted, testing will be carried out to top of the Madison.

The discovery well is Leduc-Socony 1 Chancellor, in LSD 16, 10-25-21w4, 3 miles north of Chancellor town.

CANADIAN WILDCAT SUCCESSES

Tri Zone 1, LSD 9, 27-54-22w4, TD 4,474 ft., IP 3,540,000 cu. ft. gas daily.

Texaco C-1 Majeau Lake, LSD 4, 14-57-4w5, TD 4,609 ft., IP 5,250,000 cu. ft. gas daily.

CANADIAN WILDCAT FAILURES

Melton 1, LSD 10, 7-52-25w4, TD 5,941 ft.

Schreck-Richter 1 Roseberg, LSD 4, 9-10-6w4, TD 3,461 ft.

Calmont & Associates 1 Sunland, LSD 3, 6-58-15w4, TD 3,200 ft.

EASTERN CANADA

In Huron County, Ontario, Sun Oil Co. has been making a survey and leasing acreage in the vicinity of Goderich. For some time past Imperial Oil has also been investigating the area. Plans contemplate drilling in the spring of 1952. In recent years comparatively shallow tests have been drilled at isolated points in Huron without success, but no systematic development has ever been undertaken.

Central Area

ILLINOIS

Silurian production is being opened in the Sesser pool area of northwestern Franklin County. The discovery well is Paul Mosebach 2 Span, SE SW NE 35-5s-1e, now completing in the new, deeper pay zone logged at 4,429-58 ft. Although no gage is available, the well is reported flowing a steady stream of clean oil through 1-in. choke. Pay zone was treated with 5,000 gal. of acid. Previous production in the area has been mainly from the Aux Vases, Rosiclare, and McClosky zones in the Mississippian, with some from the Devonian. The well, located 8 miles northwest of Benton, is the deepest test drilled to date in the area.

Calvert Drilling, Inc., and others have completed their 1 Pictor, SE NW SW 28-5n-10e, which opens a new McClosky producing area a mile east of the Dundas Consolidated pool in the area west of Dundas, 8 miles north of Olney, Richland County. Placed on the pump, the well made 87 bbl. of oil with 2 bbl. of water per day. Pay zone is open through casing perforations at 2,873-81 ft. Total depth is 2,965 ft. with bottom of the casing at 2,933 ft. Pay has not been acidized.

INDIANA

Benedum & Trees Oil Co. and Jack V. Canterbury have what appears to be a good McClosky lime oil discovery at their 1 Smith, SE NW SW 1-8s-11w, 8 miles south of Evansville, Vanderburgh County, and just across the Ohio River from Henderson, Ky. Saturation was logged at 2,397-2,406 ft. (total depth). A 60-minute drill-stem test got gas in 20 minutes and filled 400 ft. of clean oil and 124 ft. of oil-cut mud. No water was indicated. Bottom-hole pressure was 905 psi. The location is 6 miles from nearest production in Indiana and 3 miles from nearest production on the Kentucky side of the river. Casing has been run to 2,390 ft. for production tests.

Frank B. Murta & Son and Walter Willis 1 Montgomery, NE NW SE 5-3s-11w, 2 miles east of Owensville and ¾ mile east of production in the Owensville East pool, Gibson County, swabbed 2½ bbl. of clean oil per hour natural in initial tests of Cypress sand at 2,028-44 ft. Since then, pay zone has been shot with 30 qt., and hole at latest report was being cleaned out for further testing.

WESTERN KENTUCKY

Extension of the Spottsville pool, 8 miles east of Henderson, in eastern Henderson County, a half mile to the southeast is indicated by oil and gas showings obtained in Aux Vases sand by Felmont Oil Corp. at its 1 Hope, 21-Q-25. Saturation was logged at 2,172-80 ft. A 2-hour drill-stem test got gas in 45 minutes and recovered 750 ft. of clean oil and 95 ft. of mud-cut oil. There was no indication of water. Casing has been run through the pay to 2,230 ft.

The new Smokey pool, located 7 miles west of Owensboro near the village of Sorgho, in Daviess County, also is being extended with well located a half mile southwest of the discovery producer. The extension well, Basin Drilling Co. and others 1 Newman, in 16-P-28, flowed initially 20 bbl. of oil with 1,500,000 cu. ft. of gas per day from Tar Springs sand at 1,234-35 ft. Bottom of the hole still is in sand.

EASTERN KENTUCKY

In Springfork pool of eastern Breathitt County on Laurel Branch, United Carbon Co. has a dry hole at 30 E. J. Evans fee. Test had Maxon at 1,215 ft., Big lime at 1,492 ft., Weir sand at 1,752 ft., and Berea sand at 1,965 ft. Only a small show of gas was had to total depth of 2,017 ft.

In Big Sandy gas field in the Pike County sector, United Carbon Co. has completed a good well at 3 Edith Cassady et al. Maxon (Mississippian) sand topped at 1,480 ft. and bottomed at 1,586 ft. gaged 3,603,000 cu. ft. of gas daily, natural flow. A rock pressure of 525 psi. in 15 minutes was recorded at total depth of 1,590 ft.

In the Martin County sector of Big Sandy gas field, United Fuel Gas Co. has completed 65 Federal Gas, Oil & Coal Co. for 260,000 cu. ft. of gas daily from Devonian black shale at a total depth of 3,413 ft. Rock pressure was checked at 485 psi.

MICHIGAN

Brazos Oil & Gas Co. was testing oil pays at HE-1 State-Chester, C NE NE 15-29n-2w, Chester Township wildcat, Otsego County, after acid treatments to a dolomite section in the Salina at 6,612-25 ft., best of several potential pays in this section.

After first treatment with 1,500 gal., well swabbed and flowed 45 bbl. of gross fluid in 19 hours, 95 per cent oil. This same section was then reacidized with 4,000 gal., and during first 18 hours of swabbing well produced 130 bbl. of gross fluid, 15 bbl. of net oil.

On next swab test well flowed 55 bbl. of oil in 24 hours, and during next 24 hours, under intermitter control, well flowed 30 bbl. Present indications are that well is good for about 30 bbl. of oil a day.

Another dolomite zone in the Salina was reported to appear to be about as good as the one under test and may be tested later. This zone was logged at 5,968-86 ft., and, although porosity was tested out to be better, the permeability was reported to be less than the 6,612-25-ft. zone. Another potential pay zone was reported at 6,913-34 ft.

The oil recovered from this deep Michigan wildcat was tested out at 47° gravity at 74° F. The oil congeals at 68° F. and solidifies at temperatures below 68° F.

The present zone will be tested further and possibly be reacidized before perforations are made to test upper pay horizons.

Top of Niagaran was logged at 6,672 ft. (corrected top), and chert was logged at 6,680 ft. Hole was bottomed out at 6,712 ft. but was plugged back to 6,638 ft. before tests were started. Brazos controls thousands of acres of leases around this wildcat, and well was spotted after an intensive shallow core-drill program in the area. The wildcat is believed to be located on the top of a projected structure, based on the earlier core drilling.

ILLINOIS SUCCESSFUL WILDCATS

Richland County: Calvert Drilling, Inc., et al 1 Pictor, SE NW SW 28-5n-10e, IP 87 bbl., McClosky 2,873-81 ft., TD 2,965 ft. (new pool discovery).

Wabash County: Paul Rossi 1 Leitch, NW SE NW 23-1s-14w, IP 46 bbl., O'Hara

(Continued on page 416)

JUSTRITE

JUSTRITE... for EXTRA SAFETY!

The SAFE WAY to handle and pour flammable liquids!

SAFETY FILLING CANS

Spout cap automatically opens and closes. Swinging handle balances load. Heavy coated steel body. Built to last. Flexible spout for easy pouring. Underwriters approved and listed. 3 gal. and 5 gal. sizes.

OILY WASTE CANS

for all kinds of rags or oily waste flammable material. Heavy duty for extra protection. Cover closes automatically. Carrying handle. With or without foot lever. 4" high sturdy legs. Underwriters approved and labeled. From 6 to 25 gallons.

Approved by Underwriters Lab., Inc. and Factory Mutuals

ORDER FROM YOUR JOBBER

JUSTRITE MANUFACTURING CO.

FREE CATALOG
Write Dept. OGJ
2061 N. Southport Ave.
CHICAGO 14, ILL.

Bulletin 715.1
"Supporthead"
Centrifugals

Bulletin 710.1
"Close-Cupld"
Centrifugals

These new bulletins make it easier for you to select the right pump

These new bulletins have been designed to help you. New sizes are listed, and, in each bulletin we have put a composite rating chart which includes both "Close-Cupld" and the supporthead. This makes it dead simple to put your finger on the right pump for your requirements.

Another valuable feature of these bulletins is the parts chart. Using this you see exactly what parts are interchangeable for all size pumps and so can keep your spare parts investment to a minimum.

Send for these useful FREE bulletins *today*. Goulds Pumps, Inc., Seneca Falls, N. Y.

Goulds PUMPS INC. Seneca Falls, New York

TAC does what no other tool can do!

AT LAST! AN OPEN-END RATCHET WRENCH — the world's first *true universal* wrench. A patented design for connections on tubing, rods, piping, conduit, studs, etc. Six y-four socket sizes from ⅜" to 4". Smallest effective ratcheting arc yet — 5° to 7½°. TAC will also do every job any ordinary ratchet wrench will do: one TAC set replaces literally dozens of single-purpose hand tools.

makers of advanced tools for industry

TAC

TAC is the registered trademark of

TUBING APPLIANCE CO.

7112 South Victoria • 10321 Anza Ave. • Los Angeles, Calif.

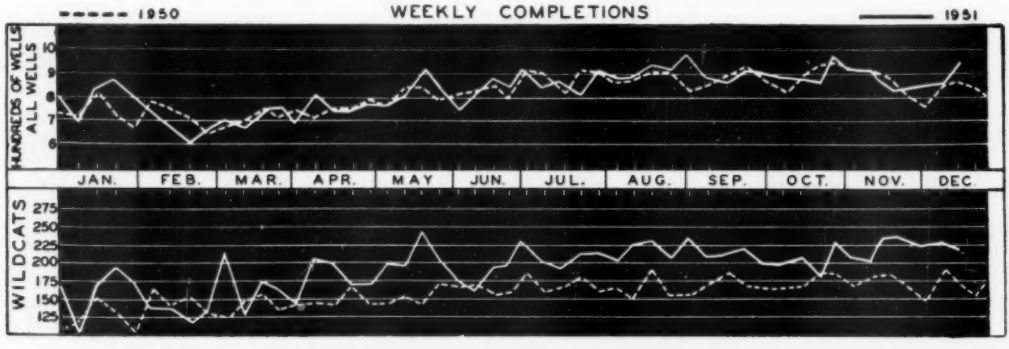
CURRENT STATISTICS

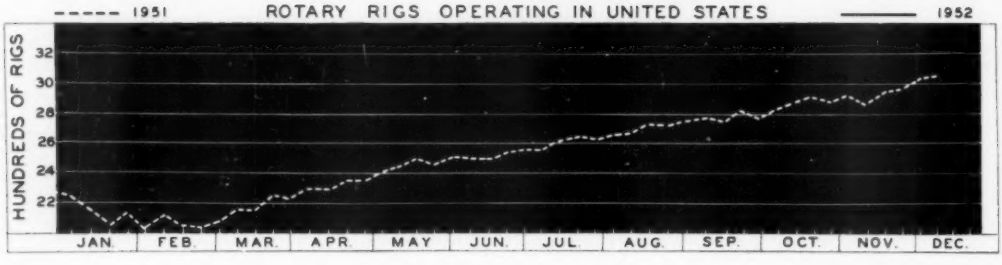
EXPLORATION

WEEKLY WELL COMPLETIONS . . . WEEK ENDED DECEMBER 15, 1951

	Total of all wells					Dec. 15		Wildcat completions and discoveries					Cumulative total, 1951				
	Comp.	Oil	Gas	Dry	Footage	1951	1950	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	13	7	*0	*6	16,500	621	646	0	0	0	0	0	0	0	0	0	0
Pennsylvania	34	19	2	†13	40,800	1,394	1,277	0	0	0	0	0	0	0	2	2	4
West Virginia	11	4	5	2	31,796	588	626	0	0	0	0	0	0	0	8	4	12
Ohio	20	7	3	‡10	50,448	940	987	0	0	0	0	0	1	0	6	27	34
Indiana	29	5	0	24	48,703	1,322	1,503	2	0	0	17	19	60	0	3	470	533
Kentucky	33	10	5	18	58,529	1,237	1,107	2	0	0	6	8	43	0	2	213	258
Illinois	52	20	0	†32	135,854	2,272	2,766	3	0	0	12	15	98	0	0	702	800
Michigan	12	4	0	8	32,705	732	857	0	0	0	6	6	17	0	6	303	331
Kansas	100	57	8	§35	347,630	4,234	3,809	1	0	0	13	14	188	1	12	861	1,062
Nebraska	5	2	0	3	13,947	228	127	0	0	0	1	1	20	0	2	110	132
Oklahoma	108	52	6	†50	423,677	5,358	5,237	1	0	0	16	17	181	5	21	709	916
Texas	356	234	9	113	1,707,876	15,947	15,895	11	1	1	76	89	720	54	127	3,335	4,236
North Central (Dist. 7-B & 9)	100	54	0	46	316,832	4,857	4,803	8	0	0	31	39	355	3	20	1,433	1,811
West (Dist. 7-C & 8)	132	111	0	†21	754,890	4,870	4,815	1	0	0	12	13	174	10	9	620	813
Panhandle (Dist. 10)	15	9	5	1	41,723	690	864	0	0	0	1	1	2	0	0	33	35
Eastern (Dist. 5 & 6)	19	11	0	8	109,007	1,106	1,101	0	0	0	5	5	10	9	2	221	242
Gulf Coast (Dist. 2 & 3)	48	20	3	25	307,246	2,204	2,227	0	1	1	17	19	91	22	53	467	638
Southwest (Dist. 1 & 4)	42	29	1	12	178,178	2,220	2,085	2	0	0	10	12	88	10	38	561	697
Louisiana	44	26	4	16	315,860	2,116	2,353	2	0	0	6	8	44	10	8	291	353
Northern	23	10	3	10	100,525	1,174	1,266	1	0	0	4	5	16	0	5	175	196
Southern	23	16	1	6	215,335	942	1,087	1	0	0	2	3	28	10	3	116	157
Arkansas	9	4	0	5	30,330	409	390	0	0	0	4	4	15	1	2	82	100
Mississippi	14	5	1	8	87,513	365	297	1	0	1	6	8	17	4	1	150	172
Southeastern States	1	0	0	1	10,020	47	58	0	0	0	1	1	1	0	0	19	20
Montana	7	2	0	5	15,586	247	264	0	0	0	2	2	0	0	1	43	44
Wyoming	8	3	0	5	37,490	716	582	1	0	0	4	5	16	0	1	107	124
Colorado-Utah	11	6	0	5	60,746	304	106	1	0	0	5	6	15	0	7	135	157
New Mexico	22	16	3	3	115,542	687	590	0	0	0	3	3	13	0	10	79	102
California	51	40	2	9	241,183	2,248	1,760	3	0	1	6	10	58	0	6	456	520
Miscellaneous (Md., S. D., Wash.)	3	1	1	1	17,091	82	54	0	1	1	1	3	1	1	26	54	82
Total United States	945	524	49	372	3,839,826	42,094	41,296	28	2	4	185	219	1,508	76	251	8,157	9,992
Total previous week	858	445	45	368	3,336,157			43	1	7	177	228	1,408	74	247	7,972	9,773
Total December 16, 1950	863	481	56	326	3,288,454			34	0	3	135	172	1,088	71	205	6,319	7,683

Service wells included: *6, †12, ‡1, §2.





DAILY AVERAGE PRODUCTION FOR WEEK

	Dec. 15 crude oil	B. of M. Dec. demand	Dec. 8 crude oil
Alabama	2,800	2,400	2,850
Arkansas	76,560	84,000	76,450
California	988,300	995,000	988,100
Colorado	72,200	75,000	80,200
Eastern	57,500	61,000	56,000
Florida	1,650	1,600	1,650
Illinois	168,500	161,000	170,800
Indiana	32,500	31,000	32,700
Kansas	327,400	319,000	325,450
Kentucky	34,700	31,000	35,300
Louisiana	601,250	648,000	601,000
North Louisiana	111,700		111,450
South Louisiana	489,550		489,550
Michigan	37,600	40,000	36,700
Mississippi	96,545	102,000	93,650
Montana	26,600	26,000	26,500
Nebraska	7,600	8,000	7,600
New Mexico	148,725	155,000	148,825
Oklahoma	517,800	530,000	516,500
Texas	2,753,050	2,780,000	2,753,050
Dist. 1 (Southwest)	32,700		32,700
Dist. 4 (Southwest)	251,900		251,900
Dist. 2 (Gulf Coast)	163,300		163,300
Dist. 3 (Gulf Coast)	462,200		462,200
Dist. 5 (Eastern)	52,600		52,600
Dist. 6 (Eastern)	123,025		123,025
East Texas field	268,500		268,500
Dist. 7-C (West)	116,150		116,150
Dist. 8 (West)	956,825		956,825
Dist. 7-B (W. Central)	84,300		84,300
Dist. 9 (N. Central)	158,000		158,000
Dist. 10 (Panhandle)	83,550		83,550
Utah	4,300	5,000	4,300
Wyoming	188,000	190,000	187,000
Total United States	*6,143,580	6,245,000	6,144,625
Change from prev. week, down	1,045		
Canada	133,229		130,700

Total U. S. production January 1-December 15 †2,143,038,244 bbl.
Same period last year (crude plus cond.) 1,888,518,115 bbl.

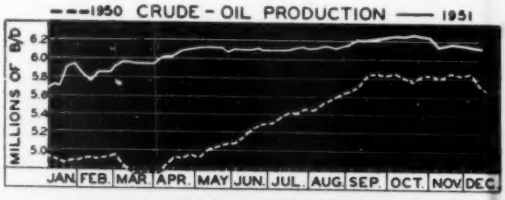
*Not including 115,507 bbl. condensate. †Including 36,954,481 bbl. condensate.

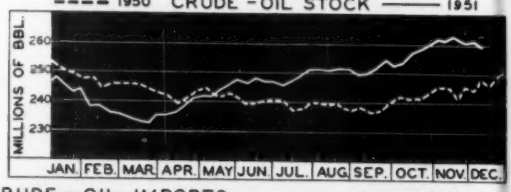
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

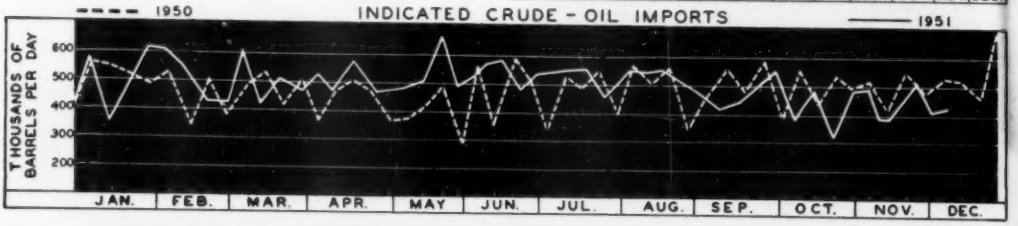
(Thousands of barrels)

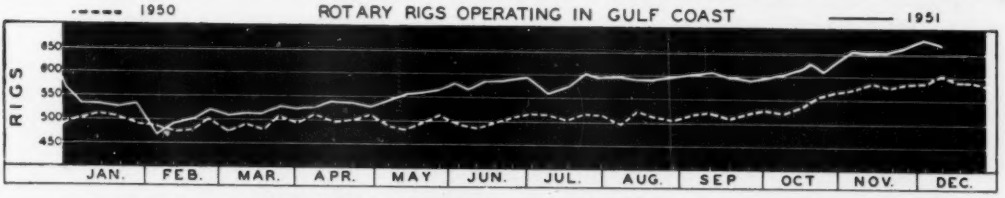
	Dec. 8, 1951	Dec. 1, 1951	Dec. 9, 1950
Pennsylvania Grade	2,017	2,086	2,129
Other Appalachian	1,792	1,867	1,257
Illinois, Indiana, Michigan	12,283	12,289	10,152
Arkansas	2,634	3,047	2,507
Louisiana	13,899	14,085	14,242
North	2,824	2,810	2,670
Gulf	11,075	11,275	11,572
Mississippi	3,371	3,546	2,344
New Mexico	8,038	6,931	6,742
Oklahoma and Kansas	40,885	40,207	38,135
Texas	126,075	128,216	119,497
East Texas	15,170	15,605	13,885
West Texas	53,408	54,874	46,235
Texas Gulf	28,487	28,198	29,416
Other Texas	29,010	29,539	29,961
Rocky Mountain	13,721	13,929	11,508
California	28,782	28,937	30,330
Foreign	5,588	5,701	7,499
Total	259,085	260,901	246,342

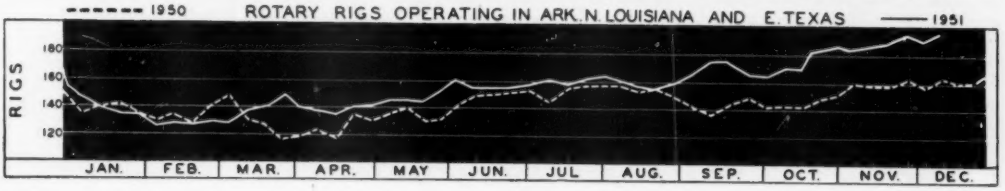
*Bureau of Mines.









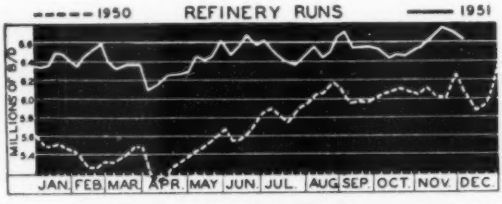

1950 ROTARY RIGS OPERATING IN ARK. N. LOUISIANA AND E. TEXAS 1951
RIGS
180
160
140
120
JAN. FEB. MAR. APR. MAY JUN. JUL AUG. SEP. OCT. NOV. DEC.

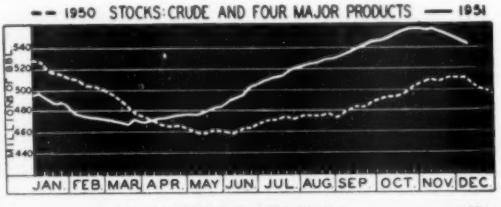
A.P.I. REFINERY REPORT, DECEMBER 8

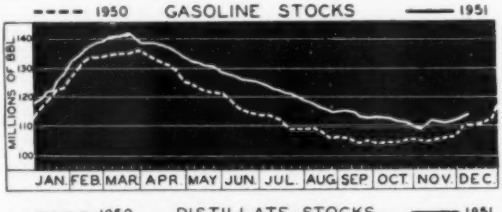
(Thousands of barrels)

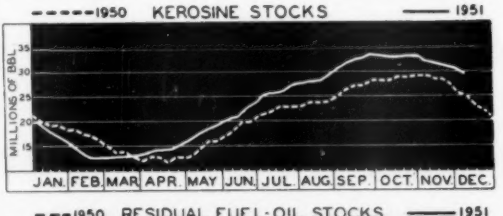
District	Daily avg crude runs	Daily average production				Stocks at refineries, bulk terminals, in transit and in pipe lines				Bureau of Mines, December 1950				
		Gasoline*	Kerosine	Distillate	Residual	Gasoline†	Kerosine	Distillate	Residual	Daily avg. crude runs	Daily average production: Gasoline*	Kerosine	Distillate	Residual
East Coast	1,062	410.9	49.4	296.9	249.1	24,396	10,324	32,387	10,761	951	386.9	44.0	254.7	234.4
Appalachian:														
District 1	100	47.6	6.0	16.4	13.7	2,787	617	897	603	95	42.0	5.2	15.5	11.1
District 2	82	43.0	5.7	14.7	19.1	1,010	376	306	271	65	32.0	5.3	7.0	16.4
Ind., Ill., Ky.	1,212	658.3	80.6	230.4	171.3	25,415	6,420	18,309	6,073	1,103	550.6	75.9	200.8	173.6
Okla., Kans., Mo.	546	313.1	16.0	129.6	70.3	12,168	1,735	11,531	1,948	514	274.5	18.6	121.2	71.4
Inland Texas	243	182.3	12.1	39.3	39.8	3,921	564	1,877	1,397	214	147.3	12.9	31.6	41.0
Texas Gulf Coast	1,601	751.2	137.0	355.3	243.6	17,412	4,774	13,989	7,078	1,506	674.6	128.0	375.2	283.2
La. Gulf Coast	501	241.1	60.6	127.1	58.3	5,939	3,067	3,652	2,110	499	235.2	52.8	132.8	64.2
N. La. and Ark.	82	37.7	7.6	17.1	8.0	2,793	618	1,287	152	69	28.1	8.3	14.6	9.9
Rocky Mountain:														
New Mexico	16	8.7		2.9	3.9	119		82	33	15	7.9	.3	2.7	3.5
Other Rocky Mtn.	230	106.1	8.4	46.9	48.6	3,750	323	1,725	1,000	213	99.7	7.1	42.8	46.0
California	932	397.3	3.0	168.1	359.0	13,875	475	8,228	14,792	900	399.9	4.9	143.9	351.0
December 8, 1951	6,610	3,197.3	386.4	1,444.7	1,284.7	113,590	29,293	94,270	46,218	6,144	2,878.7	363.3	1,342.8	1,305.7
December 1, 1951	6,700	3,192.3	375.3	1,467.3	1,311.4	112,478	30,377	96,308	46,791					
December 9, 1950	5,869	2,741.1	310.1	1,185.3	1,230.1	109,647	25,047	80,964	43,307					

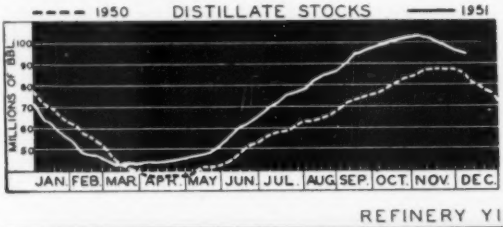
*At refineries including natural blended. †Finished and unfinished.

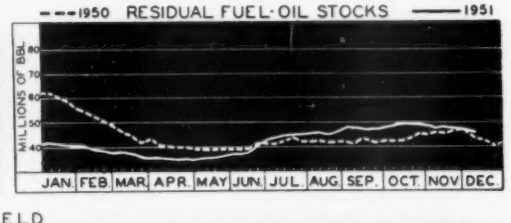


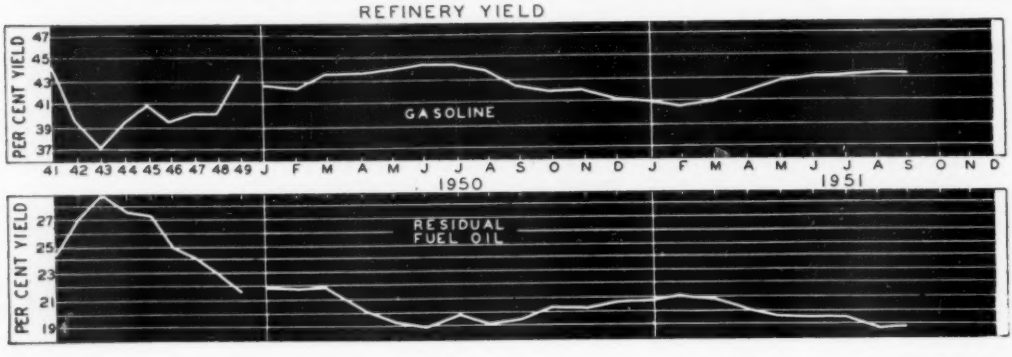











REFINERY YIELD
PER CENT YIELD
GASOLINE
41 42 43 44 45 46 47 48 49 J F M A M J J A S O N D J F M A M J J A S O N D
1950
1951
PER CENT YIELD
RESIDUAL FUEL OIL

CRUDE PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.‡	Oklahoma, Kansas	Gulf Coast Tex.*	West Tex†
18-18.9	$1.93			
19-19.9	1.98			
20-20.9	2.03	$2.25		$2.12
21-21.9	2.07	2.27		2.14
22-22.9	2.12	2.29		2.16
23-23.9	2.18	2.31		2.18
24-24.9	2.24	2.33	$2.56	2.20
25-25.9	2.30	2.35	2.58	2.22
26-26.9	2.36	2.37	2.60	2.24
27-27.9	2.41	2.39	2.62	2.26
28-28.9	2.46	2.41	2.64	2.28
29-29.9	2.52	2.43	2.66	2.30
30-30.9	2.57	2.45	2.68	2.32
31-31.9	2.62	2.47	2.70	2.34
32-32.9	2.68	2.49	2.72	2.36
33-33.9		2.51	2.74	2.38
34-34.9		2.53	2.76	2.40
35-35.9		2.55	2.78	2.42
36-36.9		2.57	2.80	2.44
37-37.9		2.59	2.82	2.46
38-38.9		2.61	2.84	2.48
39-39.9		2.63	2.86	2.50
40 and above		2.65	2.88	2.52

*For crude from Daboval, El Campo, and Sand Point.

†Includes Lea County, New Mexico. Last general price change represented a 50-cent increase becoming effective December 6, 1947.

‡Standard Oil Co. of California.

FLAT CRUDE PRICES

Representative posted schedules per barrel.	
East Texas†	$2.65
Kettleman Hills, California*	2.80
Beauregard Parish	2.60
Illinois Basin	2.77
Pecos County, Texas (Yates)	2.35
Bradford, Pennsylvania	4.25
Eastern Ill. and Western Ind.†	2.77
Tomball, Texas Gulf Coast	2.83

*37-37.9°. †35° and above.

COLDER weather in the areas of the country where distillate oils are used for home heating has resulted in firmer markets for No. 2 fuel. The cold wave that moved across the northern part of the country in the second week of December caused a big jump in movement out of secondary storage. If this is followed by a period of warm weather, the effect on refinery shipments will be spread out over several weeks. On the other hand, a continuation of cold weather in high-demand areas will result in a very large drop in distillate inventories in the last half of the month and a heavy load on transportation.

In the Mid-Continent area, many suppliers have already had increases in shipping instructions for No. 2 fuel. The price trend on the Group 3 market has shifted from spotted offerings under the low a few weeks back to the point where some suppliers are quoting on a basis of the high of the market rather than the low.

Activity in burning oils on the New York Harbor market has been confined almost entirely to material swaps with other sales restricted to regular customers.

Gasoline demand remains high but continued peak production at refineries is causing some softness in gasoline markets.

The loss of heavy-fuel production at Abadan has resulted in a shortage of bunker fuel in some foreign markets. The program for diverting some of the production from Caribbean refineries to Europe had cut residual imports in this country. At the same time, residual exports have increased. These shifts in supply and demand have produced tight markets for heavy fuel in Gulf Coast and East Coast areas.

Residual is still soft on most inland markets despite some improvement in recent weeks. Most suppliers have reduced stocks enough to discontinue extreme distress selling.

REPRESENTATIVE QUOTATIONS

Representative spot-market quotations of leading suppliers as of December 17, 1951. Figures are f.o.b. plant for tank-car shipments in cents per gallon, except for residual fuel oil which shows the price per barrel and wax, in cents per pound.

GASOLINE, KEROSINE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor (barge)	Texas Gulf Coast
Regular gasoline, 80-82 octane	10¼-10½	12-12.75	10¾-11
Premium gasoline, 86-88 octane	11¼-11½	13.5-13.75	11¾-12
42-44 w.w. kerosine	9-9⅜	10-10.1	9
No. 2 straw fuel oil	8¼-8½	9-9.25	8
No. 6 residual	$1.65-1.75	$2.45-2.60	$1.75-1.90

NATURAL GASOLINE

	North Group 3	Texas	N. La.
Grade 26-70	6⅞	6⅜	6⅝
Grade 18-55	8.25	7.75	8.0

LUBRICATING OILS

South Texas

200 vis., No. 2-3 neutral	13-13.5
750 vis., No. 3-4 neutral	16
2,000 No. 5-6 neutral	18-19

LUBRICATING OILS

Mid-Continent

150-160 vis., D bright stock, 0-10 pp.	29-36
200 vis., No. 3 neutral, 0-10 pp.	17.5-18.5

Western Pennsylvania

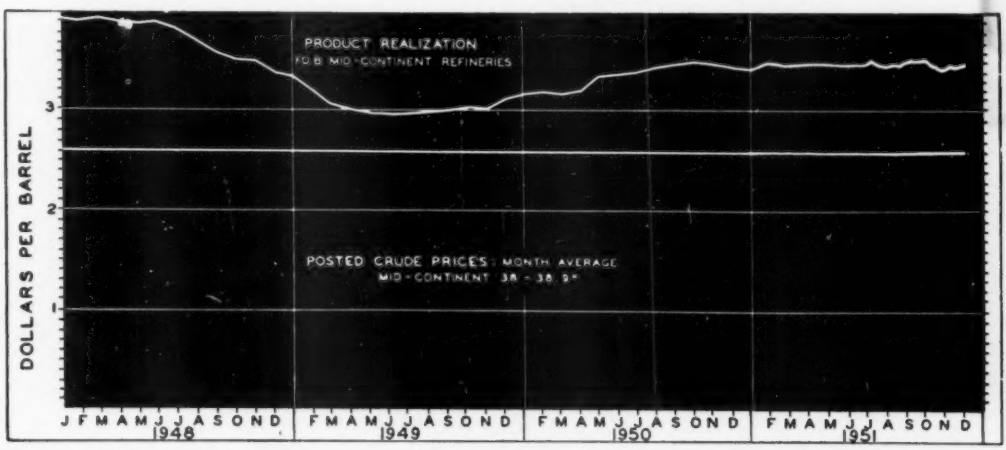
145-155 vis., 10 p.t. bright stock	32.5
180 vis., 0 p.t. neutral	31.5

WAX

Mid-Continent

132-134 A.M.P.	8.5

(Starting with the first issue of 1952, price quotations will be as of Wednesday each week instead of Monday)


PRODUCT REALIZATION
F.O.B. MID-CONTINENT REFINERIES
POSTED CRUDE PRICES: MONTH AVERAGE
MID-CONTINENT 38 - 38.9°
DOLLARS PER BARREL
3
2
1
J F M A M J J A S O N D
1948
J F M A M J J A S O N D
1949
J F M A M J J A S O N D
1950
J F M A M J J A S O N D
1951

In this trend chart refinery realization is based on average Mid-Continent grade crude oil (not 38° gravity only) and average prices for refinery products as published in The Oil and Gas Journal basis Oklahoma (Group 3). Refinery yields confined to gasoline, kerosine, distillate, and fuel oil. Realization averaged $3.48 for week ended December 8, $3.47 for previous week, and $3.50 for December 1950.

EQUIPMENT MEN . . . in the News

Mercer Is Transferred to England for Allis-Chalmers

Elwyn Mercer, industrial manager in the Southwest since 1947 for Allis-Chalmers Manufacturing Co., left recently for England where he has been appointed general manager of tractor-division operations for A-C in that country.

Mercer joined A-C in 1936. He served as industrial-sales manager at the A-C Memphis, Tenn., branch and in April of 1947 he was sent to Buffalo, N. Y., as industrial district manager. Later that year he was transferred to the home office as industrial manager in the Southwest.

A-C Tractor Division has two plants in England. The plant at Eling Mill makes Model B tractors, and the larger one at Essendine makes All-Crop Harvesters and engines for both the Harvesters and the Model B tractors.

Penn Changes Name to Penn Controls, Inc.

The firm name of the Penn Electric Switch Co. has been officially changed to Penn Controls, Inc., according to an announcement issued by Albert Penn, president.

The announcement emphasizes that the name change will not in any way alter management, general policies, or operation of the company; nor will it have any effect on contracts, agreements, or purchase orders.

Penn Controls, Inc., manufactures automatic controls for heating, refrigeration, air conditioning, gas appliances, engines, pumps, and air compressors.

Glass Fibers Purchases Interst in Vibradamp Corp.

Glass Fibers, Inc., of Toledo, Ohio, has purchased controlling interest in Vibradamp Corp., with headquarters at Los Angeles and plant facilities at Los Angeles and Santa Clara, Calif., according to an announcement made by Randolph H. Barnard, president of Glass Fibers.

The newly acquired company utilizes a Glass Fibers product, lightweight glass wool, in the manufacture and fabrication of specially designed shock mounts, vibration mounts, and other products for defense weapons in addition to many commercial applications. All are made under a patented process and sold under the trade name of "Vibraglass."

Ketcham Is Sales Manager For Anderson-Prichard

E. K. KETCHAM

E. K. Ketcham has been appointed sales manager, refined oils division of Anderson-Prichard Oil Corp. and Col-Tex Refining Co., Oklahoma City. He succeeds C. L. Mayhall, vice president in charge of refined oil sales, recently retired. Ketcham has been with Anderson-Prichard for 23 years. Originally in the traffic department he has for many years been assistant to sales directors.

W. J. Sutton, who has been with Anderson-Prichard for 11 years, has been appointed assistant sales manager.

Link-Belt Names Brinkworth To New Sales Position

Link-Belt Co. has announced appointment of William J. Brinkworth as representative, Distributor Sales, Southwest Division, with headquarters at the company's plant in Houston, Tex.

Brinkworth has been field manager, oil-field distributor sales, and continues in this capacity but will now also supervise sales through the company's many industrial distributors in the Southwestern Division.

Brinkworth joined Link Belt at the Ewart plant in Indianapolis in 1929, where he spent the first 5 years in the service of the malleable foundry, successively gaining experience in the shop, then in supervision, and later on production. This experience was followed by work in the estimating department and 8 years' experience in the sale of job-malleable iron and promal castings; then pricing and plant contacts with distributors, followed by his transfer to Houston in 1946.

Baroid Sales Celebrates New Opening at Houston

New main offices of Baroid Sales Division, National Lead Co., Houston

Official opening in Houston of new administrative headquarters of the Baroid Sales Division, National Lead Co., was celebrated by approximately 1,500 oil men on November 16, J. A. Martino, president of National Lead, was on hand for the ceremony, accompanied by other top executives of the company.

The new building, located on a 4-acre tract, contains extensive laboratory facilities for organic and analytical chemistry, mud analysis, and instrument design; also, foundry and training laboratories, mills for grinding raw materials, complete photographic and printing facilities, together with a technical library directed by a professional librarian.

George L. Ratcliffe, general manager of Baroid Sales Division, stated that in addition to headquarters in Houston, division headquarters are also maintained in Los Angeles and Tulsa. Field-service centers are now in operation in all leading oil fields. The firm's products are sold through 500 distributors, providing rush service in every active drilling area. Over 150 Baroid field-service engineers in specially equipped cars carry Baroid service direct to oil fields of the United States and Canada.

Baroid's present service includes a complete line of drilling-mud products, mud-testing equipment, well-logging service, and complete field and laboratory-engineering services.

Dearborn Chemical Adds Tinsler to Sales Staff

Dearborn Chemical Co., Chicago, has announced the addition of William A. Tinsler, Jr., to its sales staff. Tinsler is a Purdue University graduate in chemical engineering and served as an ordnance specialist in the Navy during World War II.

Prior to his addition to the Dearborn sales staff, Tinsler was engaged in research development and corrosion engineering.

Baash-Ross Appoints Richards a Director

Baash-Ross Tool Co. has announced the appointment of Howard L. Richards as director of industrial relations for its nation-wide manufacturing and operating locations. Richards brings to his new post more than 12 years' experience in the field of industrial relations, during which time he has handled labor relations with a major rubber company, a large steel and stamping organization, a major steel fabricator, and, most recently, with a major technical service company serving the oil industry.

Although headquartered in Los Angeles, Richards will spend a considerable amount of time personally checking and guiding industrial relations throughout the extensive network of 17 Baash-Ross manufacturing plants and shops strategically located throughout all the major oil territories of the United States.

General Controls Builds New Appliance Plant

Built expressly to house its recently established Appliance Controls Division, a new plant has been completed on the property of General Controls Co., Glendale, Calif., one of the nation's leading automatic-controls manufacturers, it has been announced by W. A. Ray, president.

The new facility, which covers 15,000 sq. ft. of working space, will be devoted to the manufacture of appliance controls for gas ranges, water heaters, room heaters, and other appliance specialties.

George Greenamyer, who served as works manager for the former Monrovia, Calif., operation, will continue as manager of the new division.

Richard Grayson has been appointed as head of the recently established Appliance Controls Division. John Grayson will remain with the consolidated company as director of research and development of the Grayson-Greenamyer Appliance Controls Division. He will be based in a new research laboratory located in Monrovia.

Service Awards Made by Jones & Laughlin Supply

Thirty-five-year awardees, seated left to right, are: Robert McCoy, Jr.; R. E. Howe; R. C. Hunter; J. L. Shakely; H. C. Patterson; A. G. Chamberlain; and E. A. Bement. Standing are the winners of the 25-year pins, left to right: U. G. White, Jr.; Claud L. Kent; A. G. Bastian; W. L. Vinson; E. L. Burnett; H. D. Stanley; A. A. Hopper; Frank R. DeWitt; H. H. Brown; L. G. Sutter; Miss Rector Shingo; Ford Bishop; E. E. Roush; F. E. Goodwin; John H. White; H. H. Yeakey; J. L. Purser; J. W. Zimmerman; M. K. Hatfield; H. L. Wilkins; J. W. Berry; W. E. Ossenkop, and Ira Rockhold.

On December 6, 30 employes who have completed 25 years or more of continuous service with Jones & Laughlin Supply Co., a subsidiary of Jones & Laughlin Steel Corp., were guests of J. L. Shakely, J&L Supply president, at a dinner party held in Snug Harbor Hut at Southern Hills Country Club, Tulsa. Seven 35-year pins and twenty-three 25-year pins were awarded. An additional 25-year pin was to be awarded to Harold U. Everett, district sales manager, Panhandle district, Amarillo, Tex., but due to a recent operation, he was unable to attend.

The total length of service represented by the recipients of the 35-year pins is 267 years, or an average of 38.14 years; for those receiving the 25-year awards totals 713 years, or an average of 29.71 years.

Similar occasions will be held at Houston and Pittsburgh. At the Houston party, thirteen 25-year award pins will be presented to 10 employes from Texas, two from Louisiana, and one from New Mexico. The total years represented by the 13 awardees is 370, or an average of 28.46 years.

Two 35-year pins will be presented at the Pittsburgh party. He will also award six 25-year pins. The total years' service record of the Pittsburgh group is 255, or an average of 31.88 years.

Orbit Valve Names Cole To Managerial Post

J. D. MUMFORD

The promotion of R. G. Cole to sales manager of the Orbit Valve Co., Tulsa, has been announced by J. Dock Mumford, vice president and director of sales.

Cole has recently been Gulf Coast district manager for Orbit Valve, and located at Houston, Tex. He has been associated with the company since 1941.

Another change announced by Orbit Valve is the inclusion of Dallas and Fort Worth in the territory of Peter P. Kizis, field representative for Orbit in the North Texas area. Kizis now headquarters at Wichita Falls, Tex.

American Air Filter Opens Canadian Branch

The Canadian business of the American Air Filter Co., Inc., Louisville, Ky., after January 1, 1952, will be handled by American Air Filter of Canada, Ltd., Montreal, P. Q. William G. Hole, formerly of Darling Bros., Ltd., will be in charge of all Canadian operations.

Representatives will be established in the larger Canadian cities to handle the AAF line of air filters, electronic precipitators, and roto-clone dust collectors.

Quaker Rubber Corp. Announces Promotions

Quaker Rubber Corp., division of H. K. Porter Co., Inc., Philadelphia, has appointed J. J. Merkel and E. E. Klemm branch managers of the Detroit and Cleveland districts, respectively, according to an announcement by J. R. Keach, vice president and general manager.

Both Merkel and Klemm will as-

sist their respective district managers in the operation of the sales office and warehouse.

Merkel has been associated with Quaker in a sales capacity since 1948 and has had previous experience in the rubber industry. He attended Detroit Institute of Technology and Wayne University.

Klemm has been a salesman with Quaker for more than 3 years. He is a graduate of Baldwin-Wallace College with a degree in economics and business administration.

Metcalf Appointed Sales Manager for Miller Electric

F. A. Metcalf, formerly assistant sales manager, has been appointed to sales manager of Miller Electric Manufacturing Co., Appleton, Wis., according to an announcement by N. C. Miller, president of the company.

Metcalf has been associated with the welding industry in various sales capacities for the past 14 years.

Stott to U. S. Gasket Co.

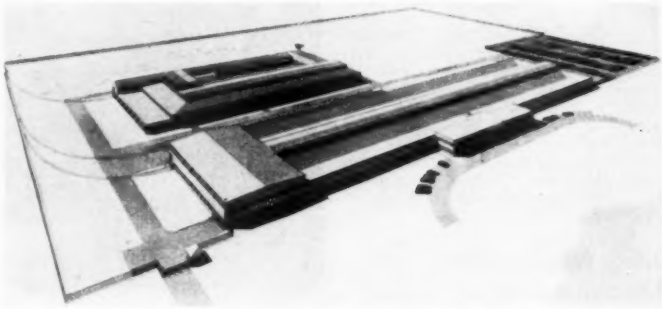
United States Gasket Co., Camden, N. J. has appointed Harry S. Stott general sales manager of both its gasket and packing division and fluorocarbon products division.

Stott formerly was sales manager of Raybestos-Manhattan's packing division.

Glitsch Holds Amual Sales Meeting at Chicago

Fritz W. Glitsch & Sons, Inc., Dallas, engineers and manufacturers of Truss-Type bubble trays, bubble caps, complete fractionating towers, and other fabricated equipment for processing industries, held its annual sales meeting in Chicago during the American Petroleum Institute's convention. Glitsch representatives at the meeting were, left to right: Allan C. Perssons, Chicago; Gordon W. Lindskog, New York; Julian J. Tunno, Tulsa, and Robert L. Allen, Cleveland. Other Glitsch executives attending the meeting but not available for the picture were H. C. Glitsch, M. C. Glitsch, K. E. Luger, S. G. Higginbotham, and R. W. Fowler.

Fairbanks-Morse to Build New Pump Plant



Fairbanks, Morse & Co. has awarded a contract to the S. Patti Construction Co. of Kansas City, Mo., for the yard work, such as sewers, roads, and other ground detail, at its new pump plant in Kansas City, Kans. Contracts have not as yet been assigned for the actual construction of the plant scheduled to begin next spring. The new plant will have a machine shop containing 190,000 sq. ft. of floor space, a foundry with 150,000 sq. ft., and an office building with 20,000 sq. ft.

Foster Wheeler Expands Activities to Canada

B. L. DENKER

Establishment of a new division by Foster Wheeler, Ltd., to serve Canada's expanding petroleum and chemical industries has been announced by George Macnoe, president and general manager. B. L. Denker, formerly of Foster Wheeler Corp., has been appointed manager of the newly formed process-plants division.

Denker will direct company activities related to the design, procurement, and construction of process plants for the petroleum, chemical, and associated industries in Canada and in the export field served by the St. Catharines industry, which has operated in Canada for the past 25 years. He has been associated with Foster Wheeler since 1942.

Denker has had extensive experience in the petroleum and chemical-engineering - design and plant - construction fields in United States, Canada, and abroad. He was associated with major installations by Imperial Oil Co. at Sarnia and Edmonton; McColl Frontenac, Edmonton; Dow Chemical Co., Sarnia; Royal Dutch Shell, Dutch West Indies, and Anglo-American Oil Co., Iran and Britain.

Sterling Names Distributors

Alan J. Bronold, sales manager of Sterling Electric Motors, Inc., at Los Angeles, has announced appointment of Allied Bearings Supply Co., Stanley Electric Motor Co., and Roy A. Berentz Co., Inc., as distributors in their areas.

D+B, Continental Hosts On Plant Tours

One of several groups of oil executives, engineers, buyers and field men who have recently visited the ultramodern sucker-rod plant operated by the D+B division of Emsco Derrick & Equipment Co., Garland, Tex., are: C. K. Trease, CSCO, Oklahoma City; Eugene Fisher, superintendent, Stanolind Oil & Gas Co.; J. A. Queen, petroleum engineer, Continental Oil Co., and Chester U. Burk, division mechanical engineer, Continental Oil Co. Back row: F. A. Lichtenheld, division engineer, Cities Service; Joe F. Cook, D+B Division, Emsco Derrick & Equipment Co.; John Miller, superintendent of production, Peppers Refining Co.; H. T. Oliphant, well-servicing foreman, Phillips Petroleum Co.; W. B. Buck, superintendent, Phillips Petroleum Co., and J. R. Govett, petroleum engineer, Continental Oil Co. The D+B Division and Continental Supply were joint hosts on these recent series of plant tours.

CLASSIFIED ADVERTISING

Your MARKET PLACE FOR THE OIL AND GAS INDUSTRY...

DISPLAY CLASSIFIED
$12.00 a column inch one issue . . .
10% Discount three or more issues.

UNDISPLAYED CLASSIFIED 15c a word one issue. 10% Discount three or more consecutive issues. $3.00 minimum charge. Blind Box in our care nine words. Payable in Advance.

EQUIPMENT FOR SALE

FOR SALE: Seamless casing and tubing new and second hand. Phone Rogers Pipe and Supply Co., Tulsa, Okla.

FOR SALE: Ten model WJD-3-A Briggs Lube Oil Clarifiers. Alfred B. Kern, 223 Wright Bldg., Tulsa, Oklahoma.

PIPE threading machines. One—3½" to 7". One—6" to 14". Complete with 10 HP electric motors, switches, and dies. Excellent condition. Will sacrifice price for quick sale. See at Western Construction Co., Hobbs, N. M. Phone 3-4134.

FOR SALE: Westcott, Foxboro and Emco Gas Meters. Geo. R. Milner, Box, 124, Okmulgee, Oklahoma.

LIGHT PLANTS: New and rebuilt. Witte & Shepherd. Diesel Light Plants, 5 to 15 KW, A. C. 60 Cycles, 110-120 Volts. Single or 3 Phase. Priced to sell. Irick Electric Co., Inc., Box 928, Gallup, New Mexico.

FOR SALE: One super model Wilson single drum servicing unit, 80 hp. Waukesha 1,000' wire, all tubing tools, mounted on GM 4-wheel drive truck. $3500. Phone Rogers Pipe and Supply Co., Tulsa, Okla.

6—10 x 301 Riveted Pressure Vessels. 10—6 x 40' Soaking Drums. All made of 1½" Steel Plates and coming from Oil Refinery. A. MARX & SONS CO., INC. P. O. Box 889, New Orleans 2, La.

FOR SALE: Used Hughes Tool Co. Pipe & Joints 4½" 16.60 lbs. Internal Upset Grade "B" Range 2, with 5½" Regular Acme Tool Joints. Approximately 4,000 Feet. Oriental Refining Co., Denver, Colorado.

FOR SALE at our El Dorado (Oil Hill) Kansas Warehouse, one 10-20 McCormick Deering Steel Wheel Type Tractor with Shaffer, Jr., Front End Winch, $350. Also Model FS-35 Cardwell Skid Type Pulling Winch Powered by Ford Motor, $750. No Masts. Cities Service Oil Company, Patridge, Bartlesville.

STANDARD BLACK PIPE

65,000 feet Used 1¼"
.140 wall
PE or T & C

45,000 feet New 2"
.154 wall
Plain end

100,000 feet Used 2"
.154 wall
PE or T & C

17,500 New 4" OD

TUBING

12 gauge wall
Pressure tested
Electric weld
Plain end

2,000 feet New 26" OD
.281 wall
Electric weld
Plain end

Write—Wire—Phone

SONKEN-GALAMBA CORP.
2nd and Riverview (X-796)
Kansas City 18, Kansas
THatcher 9243

EQUIPMENT FOR SALE

83—6" & 8" T's & L's. 3 Reducers. 1—10" L. Crane 125# cast, flange. Used, clean, new condition. ⅓ off net price. C. Pierce, 2436 Clinton Ave., Minneapolis 4, Minn.

SPUDDERS, rotaries, core drills. New and reconditioned equipment. Tools, cable, drill pipe, casing, tubing, pump jacks in stock. Everything for well service. Fishing tools rented. Pressey & Son, Pueblo, Colo.

7500' OF API Full Hole 4½" Drill Pipe. Graded and tested by Sonoscope engineers. Milford Giffin, Giffin Hotel, Tel. 477, Hoisington, Kansas.

EQUIPMENT FOR SALE: One U.O.P. center wall up draft heater, two pass arrangement, containing 27 3¾" x 3" x 40' convection tubes, 4 3½" x 2¾" x 40' shock tubes, 7 3½" x 2¾" x 40' hip tubes, and 22 3½" x 2¾" x 40' radiant tubes in each pass, all tubes 7% chrome ½% moly. Unit is complete with tubes, headers, steel work, refractory stock, and breaching, dismantled and ready for shipment. American Liberty Oil Company, Box 1011, Mt. Pleasant, Texas.

EQUIPMENT FOR SALE

USED rotary and cable tool drilling tools, wire lines, E. A. Kelly, Box 861, Oklahoma City. Phone 5-6407.

AS IMPORTERS of Steel we can furnish you with European or Japanese Steel Products of all types. Let us have your inquiries. Hemisphere International Corp., 1404 Hibernia Bank Bldg., New Orleans, La.

2300' 5½" Lapweld Casing 17/20 lb. used, but in good condition. $2.00 ft. Phone 88, Pawhuska—Mr. Hudson.

MODEL S Cardwell draw works powered by W.A.K. Waukesha gas butane motor. Model WS Cardwell mud pump unit consisting of Model 16-P Wilson Snyder 6 x 16 mud pump, and Model 6 W.A.K. Waukesha gas-butane motor; 87' Lee C. Moore Cantilever drilling mast complete with substructure; 7500' practically new 2⅞" drill pipe with tool joints; Drill collars, light plant and all auxiliary equipment including hand tools. Very complete. Available for inspection West Texas. Box E-509, The Oil and Gas Journal, Tulsa, Okla.

ATTENTION PIPE BUYERS!!

PLACE ORDERS NOW!!

EXCELLENT HIGH PRESSURE FLOW LINES:

20,000'	3"	O.D. x	.220/.250"	Wall	6.9#	New Smls. Tubing, 18'-30'
75,000'	3"	O.D. x	.270/.340"	Wall	8.9#	New Smls. Tubing, 25'-30'
7,000'	3"	O.D. x	.350/.400"	Wall	10#	New Smls. Tubing, 18'-30'

THOROUGHLY RECONDITIONED SEAMLESS BOILER TUBES AND NEW ELECTRIC WELD TUBING—ALL TESTED 1,000± P.S.I.:

							Substitute For:
125,000'	1½"	O.D. x	Approx. .134"	Wall	2.1#	14' and Over	1" Std. Pipe
50,000'	2"	O.D. x	Approx. .140"	Wall	2.7#	14' and Over	1½" Std. Pipe
50,000'	2¼"	O.D. x	Approx. .140"	Wall	3.2#	14' and Over	2" Std. Pipe
50,000'	3"	O.D. x	Approx. .145"	Wall	3.8#	14' and Over	2½" Std. Pipe
50,000'	3¼"	O.D. x	Approx. .145"	Wall	4.5#	14'-30'	3" Std. Pipe
75,000'	3½"	O.D. x	Approx. .145"	Wall	5.4#	14'-30'	3" Std. Pipe
50,000'	4"	O.D. x	Approx. .148"	Wall	6.5#	14'-30'	3½" Std. Pipe
100,000'	4"	O.D. x	Approx. .180"	Wall	7.5#	20'-30'	3½" Std. Pipe
30,000'	4½"	O.D. x	Approx. .156"	Wall	7.2#	30'-40'	4" Std. Pipe
50,000'	4½"	O.D. x	Approx. .188"	Wall	8.6#	20'-40'	4" Std. Pipe

LARGE O.D. LINE PIPE—NEW AND USED:

34,000'	20"	O.D. x .250"	Used Lapweld	52.80#	22'-40'
560'	24"	O.D. x .312"	New Electric Weld	79.05#	40'
1,900'	26"	O.D. x .281"	New Electric Weld	77.50#	40'
2,340'	30"	O.D. x .375"	New Electric Weld	125#	40'
2,250'	30"	O.D. x .500"	New Electric Weld	167#	40'
4,500'	36"	O.D. x .250"	Used Riveted	95.37#	15'-22'

OTHER SIZES ⅛" TO 36" O.D. NEW AND USED STANDARD, EXTRA HEAVY, DOUBLE EXTRA HEAVY PIPE, SEAMLESS AND ELECTRIC WELD TUBING AND CASING.

PLACE YOUR ORDER NOW, MATERIAL SUBJECT TO PRIOR SALE, WIRE OR PHONE COLLECT TODAY—NOW!

A. J. STRUBEL, Broker
4946 Murdoch, St. Louis, Mo. SIdney 1791 (Day Phone) HUdson 8152 (Night Phone)

EQUIPMENT FOR SALE

10,000 FT. of good used 5½ OD plain and line pipe. Priced low. Lee Morrison Supply Co., Phone 277, Box 230, Bartlesville, Oklahoma.

SPUDDERS: 2 "K" Type Stars, 1 Super H. Fort Worth improved, located Eastern Kansas; with or without tools, many extras. 305 Burk Burnett Bldg., Forth Worth, Texas.

ROTARY MUD PUMP: 6 X 16 Oilwell, good condition, recently overhauled, subject your inspection. $6500.00. Write Howse Drilling Company, 208 Grant Bldg., Abilene, Texas. Phone 2-3780.

Gaso Duplex 4½" x 6" Power Pumps with Chrysler C-36 Engines, skid mounted, immediate delivery. Also Byron Jackson, Carter Centrifugal Units. Westinghouse 20-25-50 KW Generating Units.

H. H. COFFIELD
Attn.: W. H. ORR
Phones: 132—Rockdale, Texas
AT-3427—Houston, Texas

Two 175 H.P.

Heine Boilers Type "M"

H.W.T. 250 lb. pressure
Boilers in good condition

Priced right

Write for full particulars and price

SONKEN-GALAMBA CORP.
2nd and Riverview (X-800)
Kansas City 18, Kansas
THatcher 9243

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

KILNS—COOLERS—DRYERS

- 1106-35 Roto-Louvre.
- 7'x60'x3/8" with lifters.
- 6'x14'x9/16" Struthers-Wells (2—NEW)
- 5'x67'x5/16" with lifters.
- 4'x34'x5/16" Struthers-Wells.
- 4'x25'x5/16" brick-lined.
- 4'x16'x3/8" Iowa with burner & stack.
- Turbulaire N2 with filter.
- Stokes 59AB w condenser, dust collector & motor.
- Spray 3'x6' Laboratory, Sta. Steel, elec. heated.
- Vac. Buflovak 24"x20" SS drum, cast aluminum casing.

PROPANE PLANT

Complete plant vaporizing & mixing equipment, including 18,000 gal. storage capacity in 3—6,000 gal. tanks, ASME U69, 200 PSI WP.

SEND FOR OUR BROCHURE

HEAT & POWER CO., INC.
70 Pine St., Hanover 2-4890, New York 5
Machinery & Equipment Merchants

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

EQUIPMENT FOR SALE

FOR SALE: In the Chase-Russell, Kansas area three 94' angle iron rotary drilling derricks standing. Cities Service Oil Company, Patridge, Bartlesville, Okla.

PIPE

All sizes; line pipe and casing, tanks, and Oilfield supplies. Edco Pipe & Supply Co., Phone 98434, P.O. Box 4193, Tulsa, Oklahoma.

SPECO TOOL COMPANY

List your oilfield equipment with us. For trade or sale.
We buy and sell all types of used oilfield equipment.
Oil Field Maintenance & Repair Machine Shops.

Texas representative—James Geurin
3809-33st. Lubbock, Texas
Phone 38711

Salem, Ill. Phone 915 **Crossville, Ill. Phone 841**

EQUIPMENT WANTED

WANTED: R. or R.L. Cardwell double drum spudder in good condition capable of working to 7,000'. Box E-497, The Oil and Gas Journal, Tulsa, Oklahoma.

WE BUY well drilling equipment, machines, cable tools, pipe, etc. Turn your surplus equipment into cash. Pressey & Son, Pueblo, Colorado.

WANTED: Triplex Type Pumps, minimum 500 barrels per day capacity at 1,000 PSI and 0 to 10 PSI suction and up. 1" Regular Black Line Pipe; 1" long collar line pipe and 1¼" upset tubing. Must be in good condition. Lynch Oil Company, P. O. Box 814, Evansville, Indiana.

WANTED FOR CASH

Oil Well Type Motors in ratings 15/30-20/50-25/65 or 35/75 Horsepower. Will buy other type motors.

ALLIED ELECTRIC & MACHINERY CO.
1007 Falls Bldg., P.O. Box 1138
Memphis 1, Tenn.

We Wish to Purchase
1950-1951
Bucyrus-Erie Spudder
either a 48-L or 36-L
Keta Gas & Oil Co.
Terminal Building Bradford Penna.

WANTED—GOOD USED DRILLING EQUIPMENT

1—Triple Lee C. Moore, or similar, drilling mast with 7 foot substructure
1—150 ton BJ, or similar, hook
1—150 ton swivel
1—4 sheave 150 ton traveling block grooved for 1⅛" line
1—4¼" x 40' square Kelly
1—13⅜" Shaffer type 39 or 40 double B.O.P.
1—Link belt, or similar, shale shaker

GEHRING EQUIPMENT COMPANY
P.O. Box 2290 Casper, Wyoming

ROYALTIES

MONTANA ROYALTIES
Millions of acres now leased by world's major companies, with huge drilling play in prospect. For booklet describing Montana geology and oil development, write Landowners Royalty Company, Box 1228, Great Falls, Montana.

WE will buy producing or non-producing oil royalties. Standard Security Company, 111 Broadway, New York 6, N. Y.

LEASE AND DRILLING BLOCKS

OIL LEASE—Approximately 800 acres, Beauregard Parish, Louisiana. 585 acres in Section 19 & 30, Township 2, Range 7, 80 acres in Sec. 6, Township 3, Range 8, 105 acres in Sec. 1, Township 3, Range 9. Lands in deep pay area, much activity. All surrounding acreage leased. Personal interviews. Alice Dickinson et al, Tel. 6 R, Lake Arthur, Louisiana, for appointment.

WILL pay cash instantly for leases (large blocks), royalties, mineral deeds, production. Write fully—P. O. Box 2153, Denver, Colorado.

CAPITAL immediately available for geologically attractive Drilling deals and oil producing properties. Send full particulars. Box E-434, The Oil and Gas Journal, Tulsa, Oklahoma.

GAS property for sale in Wolf County, Kentucky. Three million feet open flow from twelve wells in the salt sand. These wells are scattered over a large acreage. There is a good market fourteen miles away. This property is on a good road. 2205 Bath Ave., Ashland, Kentucky.

200 ACRE oil lease, need $4,000.00 for a ½ interest to drill well to Arbuckle. Dutcher sand was 100 feet high in this well. Good possibilities. L. Price, Coweta, Okla.

OFFER attractive shallow wildcat drilling deal. W. H. Mahon, P.O. Box 821, Brownwood, Texas.

READ Tulsa Oil and Gas Journal Oct. 16, pages 72 & 181, Imperial County, California, 5 year leases (rental paid 3 yrs.) on Geological-Geophysical structures. $200 per 40 acres. Write Main P.O. Box 30, Los Angeles.

WILL furnish leases on personally owned proven and semi-proven oil lands, on mutually favorable terms to reliable parties who will drill 5,000 feet if necessary. E. L. Stratton, Pecos, Texas.

FOR SALE: Proven acreage for water flooding 20 & 50 feet of sand. Core analysis report available. $10,000 & Up. J. L. Hassett, Casey, Illinois.

WYOMING-COLORADO HOT SPOT

Have structure proven for shallow production—Mapped by U.S.G.S. and Major Oil Co. Geologists—Adjacent leases held by largest Major Oil Companies. 3 locations made for deep tests—$250,000.00 oil loan wanted to drill proven lease. Pay top interest and share in property after repayment. S. M. James, 1320 East Drachman St., Tucson, Arizona. Phone 2-2464.

WE want a good drilling block, some production with proven or semiproven acreage to be drilled preferred, from owner principals. Must be good properties. Box E-460, The Oil and Gas Journal, Tulsa, Okla.

FOR SALE: Oil and Gas Leases adjoining producing leases, also wildcat leases, drilling propositions and small producing properties; all in shallow territory. W. P. Harley, Bowling Green, Ky.

LEASES ROYALTIES
Producing and Nonproducing
Bought and Sold—Any Area
Inquiries Invited
B. D. BUCKLEY
6635 Delmar Ave., St. Louis 5, Mo.

FOR SALE—MAPS

NORTH DAKOTA and South Dakota Base Maps—County outline, Township and Range, location of wells and Operators name with total depths. Oil and Gas Fields. 1" = 8 miles. Price $5.00 each. County Maps: Fee ownership and lease with expiration dates. Scale 1" = 4,000 ft. Northwest Mapping Co., 117½ Fourth St., Bismarck, North Dakota.

EQUIPMENT FOR SALE

EQUIPMENT FOR SALE

Model FXZ Gardner-Denver 7¼ x 12 mud pump. Complete mounted on skids. This pump has been completely overhauled and $2100 of new parts installed. Location: Mountain Iron & Supply Co., Plainville, Kansas.

Lee C. Moore S. H. Cantilever Mast with 5-sheave crown block, 45 ft. long base, racking board, catline sheave and extension brackets. This is a 127 ft. mast and can be converted to 97 ft. Location: Mountain Iron & Supply Co., Great Bend, Kansas.

CALL, WRITE, OR WIRE

THE MOUNTAIN IRON & SUPPLY COMPANY

Phone: 7-4238 Fourth National Bank Building Wichita, Kansas

HELP WANTED

REFINERY Chief Engineer 26-40 with experience in both process and mechanical engineering; should be qualified to supervise mechanics of modern refinery with catalytic operation. Contact The Derby Oil Company, Wichita, Kansas.

ENGINEERS, geologists, draftsmen, geophysical field men, etc., write for information on Rocky Mountain area oil jobs. Professional Placement Service, 516 University Bldg., Denver, Colo.

ENGINEER to handle office detail and engineering work. Includes application of pumps for oil industry. Location Tulsa. Position leads to advancement to sales Engineer. Applicant should be graduate Mechanical Engineer, 25-30 years of age. Write giving age, education, salary desired, and experience if any, direct to Goulds Pumps, 20 East Archer, Tulsa, Oklahoma.

RESEARCH Metallurgist—26-40—B.S., and preferably advanced degree in metallurgy or metallurgical engineering. Should have experience with all types of laboratory apparatus for metallurgical study and experience in selecting materials for all types of services. Corrosion studies, materials selection, and anlysis of failures will constitute the bulk of the work. Salary open. Location—Ponca City, Oklahoma. State age, experience, education, and salary desired in opening letter. Write direct to Personnel Records Division, Continental Oil Company, Ponca City, Oklahoma.

KEY Seismograph Personnel Needed by Established and Expanding Seismograph Company. Box E-264, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGISTS with masters degrees having 3 years or under experience. Petroleum Engineers with 1½ or more years well work experience. Experimental geophysicists under 40. Experienced landmen with law degrees under 35. Topographical draftsman. Excellent employer. Good salaries. Experienced oilwell supply storemen, store managers and salesmen. No fees. Tom Robinson, owner Oil Industry Employment Service, 405 Tuloma Bldg., Tulsa, Okla. 4-5974.

DESIGN ENGINEER WANTED

Southern California manufacturer needs a design engineer, experienced in valves and fittings for the Oil Industry. Permanent position with excellent future. Please submit outline of formal training and experience. Mail to Box E-501, The Oil and Gas Journal, 211 S. Cheyenne Ave., Tulsa 1, Oklahoma.

HELP WANTED

RESEARCH Engineer—26-40—B.S., and preferably an advanced degree in petroleum or mechanical engineering. Must be widely experienced in well completion practices. Will be responsible for research program in well completion practices and well mechanics. Salary open. Location—Ponca City, Oklahoma. State age, experience, education, and salary desired in opening letter. Write direct to Personnel Records Division, Continental Oil Company, Ponca City, Oklahoma.

WANTED an experienced geologist who can find oil for an independent oil company operating in the Gulf Coast Area. Box E-495, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED petroleum refinery process engineer with good prior training in both process engineering and plant operation. If you have satisfactory training and experience the position is in line for top job in a Mid-Continent refinery. Box E-488, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Petroleum chemist or treating engineer with two to four years' experience in gasoline treating for technical service with large chemical company selling to the petroleum industry. Position involves considerable traveling in East and Middlewest. Please include details of education and professional experience, as well as a recent photograph, in first letter. Box E-506, The Oil and Gas Journal, Tulsa, Oklahoma.

RESEARCH Group Leader and Research Engineer—26-40—B.S., and preferably a Ph.D. in physical chemistry, physics, petroleum engineering, or chemical engineering. Should have experience in reservoir engineering, reservoir mechanics research, or fluid flow research. Will be responsible for research program in multiphase flow and other aspects of reservoir mechanics. Salary open. Location—Ponca City, Oklahoma. State age, experience, education, and salary desired in opening letter. Write direct to Personnel Records Division, Continental Oil Company, Ponca City, Oklahoma.

SEISMOGRAPH. Excellent opportunity for experienced geophysicist with aggressive independent contract company to supervise contract crew. Salary dependent on experience. Write giving details, all replies held strictly confidential. Box E-513, The Oil and Gas Journal, Tulsa, Oklahoma.

DISTRICT GEOLOGIST: Aggressive independent oil company desires to hire experienced Geologist for Tulsa headquarters. Experience in West Texas-New Mexico are highly desirable. Box E-514, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

ROCKY MOUNTAIN AREA oil jobs our specialty. Engineers, geologists, draftsmen, geophysical field men, etc., write for information. Professional Placement Service, 516 University Bldg., Denver, Colo.

OIL JOBS, Rocky Mountain Area, for engineers, geologists, draftsmen, geophyhical field men, etc. For information write Professional Placement Service, 516 University Bldg., Denver, Colo.

PARTY CHIEF—Wanted by Independent Seismograph Company. Salary above average. Applicants should have not more than five years' experience. Box E-494, The Oil and Gas Journal, Tulsa, Okla.

SITUATIONS WANTED

GRADUATE mechanical engineer, 2 years experience in drilling and production, desires work in production. Will locate in southwest, west coast or foreign. Will be released from Air Force latter part of January. Box E-512, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST desires change. Four years experience in southern Oklahoma, three with a Major Co. and one with an independent. Box E-517, The Oil and Gas Journal, Tulsa, Oklahoma.

ATTENTION: Well established oil well drilling contractor desires to manage and supervise: Individuals', groups', small or medium-sized oil companies' drilling, production and operating problems in Central and Western Texas, and New Mexico Personal interview by appointment is desired. Makin Drilling Company, Box No 131, Ph. No. 131, Hobbs, New Mexico.

FORMER Independent Oil Operator ten years, with legal education, plus eight years Wall Street experience, desires connection raise funds exploratory well drilling from excess profits taxpayers. Box E-396, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST—Woman with initiative. 9½ years exceptional subsurface experience Texas and Mid-Continent. Unmarried. M. A. —49 hours geology. Desire good position with future. Box E-505, The Oil and Gas Journal, Tulsa, Okla.

REFINERY SUPERINTENDENT, experienced 5,000 to 10,000 bbl. plants, desires connection with independent refinery. Box E-510, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERT TITLE MAN will retire as mayor of Newark, Ohio, on January 1, and will be available for employment with company operating in Southwest. Experience includes 12 years as Court Clerk, Licking County, Ohio, and 4 years as mayor of Newark. Good education. Age 42. Edwin Haynes, Mayor, Newark, Ohio.

CIVIL ENGINEER, 3½ years experience refinery maintenance and construction with major oil company. Will consider foreign and domestic service. Box 1001, Sunburst, Montana.

EXECUTIVE POSITION DESIRED

Tweny years Gulf Coast experience in geology, leasing, and producing oil. Presently employed, but desire change to an independent firm who is looking for an elert, aggressive man who can find you the oil. Want compensatory salary and opportunity of participating in profits. **Box E-515, The Oil and Gas Journal, Tulsa, Oklahoma.**

AVAILABLE
Production Superintendent or Chief Engineer

Graduate Petroleum Engineer, Geological option, middle thirties, advanced from roustabout through chief engineer to assistant superintendent. Association with major and 18,000 BD independent. Experience throughout Mid-Continent; Gulf Coast limited. Complete background in drilling, production and reservoir engineering, production supervision, and limited gasoline plant operation. Well known in Mid-Continent, top references. Available after thirty days notice, salary consideration reasonable, major or reliable independent. **Box E-516, The Oil and Gas Journal, Tulsa, Oklahoma.**

WANTED
REFINERY ENGINEERS

Employment opportunities now available for qualified graduate engineers with an American oil company in South America.

DESIGNERS
Structural, Electrical, and Piping

Five to eight years' experience necessary to qualify. Will be required to draft, design, and check oil refinery installations. Will make field investigations and determine economical practices as well as make recommendations for repairs.

MAINTENANCE ENGINEERS

Two to six years' experience in maintenance and construction division of a refinery or equivalent experience in refinery construction required. Will work in planning, scheduling, and coordination of maintenance and construction.

EQUIPMENT INSPECTORS

Two to five years' oil refinery process equipment inspection experience required. Will arrange and conduct inspections, request equipment renewals due to corrosion, failure, or defectiveness in conformance with accepted safety codes. Will conduct tests of equipment, study causes and prevention of corrosion and failure of metals.

Write giving complete address, age, marital status, and complete details of previous experience. Your reply will be held in strict confidence.

Box 308-M
Radio City Station
New York 19, New York

LEGAL BLANKS

BURKHART LEGAL BLANKS since 1908. Oil-Gas (all states), Business, Real Estate, Legal Forms, Leases, Revised With Government Regulations, Commercial Printing. Catalog and Samples on request. Burkhart Printing & Stationary Company, 115 South Cincinnati, Tulsa, Oklahoma.

BUSINESS OPPORTUNITIES

COMPETENT Record keeping, Machinery and equipment inventories, Payrolls, reports within 500 miles of Tulsa office. Replies confidential. Box E-481, The Oil and Gas Journal, Tulsa, Oklahoma.

THREE Drive In Theaters, $350,000.00 Terms. Sound Investment. Will Stand very Closest investigation. Southwest Texas. Reason for Selling, old Roughneck retiring. Made his. Box E-468, The Oil and Gas Journal, Tulsa, Oklahoma.

BRITISH Engineering Company with considerable work facilities doing large business in vessels, pipes and fittings with oil, chemical and steam industries, would be interestd in a manufacturing or selling association with American firm. Box E-502, The Oil and Gas Journal, Tulsa, Oklahoma.

MANUFACTURERS representative desires additional line for oil industry. Well established coverage of Oklahoma, Kansas and North Texas. Box E-486, The Oil and Gas Journal, Tulsa, Oklahoma.

REAL ESTATE

HOTEL well equipped, modern, 3 story brick, 42 rooms, 18 with baths, doing good business, located in college town, ranch and farm community. L. C. Larson & Son, Chadron, Nebraska.

Air Conditioned
Open Area Office Space
FOR LEASE

10,000 (approximate) Square Feet

NEW, ATTRACTIVE, MODERNLY EQUIPPED

(5,000 feet on each of two floors)
Toilet facilities on each floor

SILVER STATE SAVINGS & LOAN BUILDING

1636 Welton Street

Excellent for general offices large corporation

Inquire GEORGE THOMAS

VAN SCHAACK & COMPANY
Denver 2, Colorado
624—17th Street **Ac. 1661**

LEGAL

U. S. DEPARTMENT OF THE INTERIOR. Bureau of Land Management, Washington 25, D.C. Notice is hereby given that four tracts of land totaling approximately 680.98 acres, in Ts. 6 and 7 S., Rs. 21 and 22 E., P.M., Montana, within the known geologic structure of the Dry Creek field, will be offered for oil and gas leasing, through competitive bidding to the qualified bidders of the highest cash amounts per acre, at 1 p. m., Eastern Standard Time, January 30, 1952, when bids will be opened. The details of the lease offering and how and where to file bids may be obtained by addressing an inquiry to the Land and Survey Office at Billings, Montana, or to this office. Marion Clawson, Director.

LEGAL

U.S. DEPARTMENT OF THE INTERIOR. Bureau of Land Management, Washington 25, D. C. Notice is hereby given that two parcels of land in T. 19 N., R. 5 E., La. M., containing approximately 80 acres, within the known geologic structure of the Monroe field, Louisiana, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre, at 1 p. m., Eastern Standard Time, on January 30, 1952, when bids will be opened. Details of the lease offering and how and where to file bids may be obtained by addressing an inquiry to this office. Marion Clawson, Director.

Central Area

(Continued from page 404)

2,931-35 ft., TD 3,004 ft. (extension New Harmony Consolidated pool).

White County: George & Wrather et al 1 Reuben Winter, SW NW NW 32-4s-10e, IP 300 bbl., O'Hara 3,118-25 ft., TD 3,263 ft. (new pool discovery).

ILLINOIS WILDCAT FAILURES

Clinton County: Otis S. Bugg 1 Strotheide, SW NW SE 29-3n-3w, dry, TD 2,480 ft.

Edwards County: Calvert Drilling, Inc., 1 Crome, NW SW SE 16-1n-10e, dry, TD 3,346 ft.

Gallatin County: Barron Kidd 1 Rider, NE NW SW 35-8s-9e, dry, TD 2,973 ft.

Jefferson County: E. H. Kaufman 1 Troutt, SW NE NW 7-2s-2e, dry, TD 2,355 ft.

Ralph Halbert and W. D. Jennings 1 Arnold, SE SE NW 24-2s-3e, dry, TD 3,108 ft.

Ralph Halbert 1 Taylor, NW SW NE 19-4s-3e, dry, TD 3,041 ft.

Lawrence County: V. R. Gallagher 1 Carter, NW SW NE 19-2n-13w, dry, TD 2,993 ft.

Marion County: T. S. Doran 1 Alexander-Neff, SW SW NE 8-2n-4e, dry, TD 2,833 ft.

Richland County: Calvert Drilling, Inc., 1 Sager-School, NW NW NW 7-3n-9e, dry, TD 3,090 ft.

Washington County: Continental Oil Co. 1 Geppert, NE NE NE 12-3s-4w, dry, TD 2,774 ft.

Wayne County: Gulf Refining Co. 1 Winzenburger, SE SW NW 18-3s-9e, dry, TD 3,532 ft.

White County: B. J. Taylor and L. A. Schumacher 1 Hubele, SE SE SW 5-5s-9e, dry, TD 3,413 ft.

INDIANA SUCCESSFUL WILDCATS

Pike County: Juan Drilling Co. 1 Wilkerson, NW SW SW 7-1n-8w, IP 20 bbl., Jackson 1,220-29 ft., TD 1,229 ft. (extension Union-Bowman pool).

Warrick County: Sunlight Coal Co. 61 Carter, SW NW SE 22-5s-8w, IP 240 bbl., McClosky 1,760-63 ft., TD 1,763 ft. (discovery well Boonville pool).

INDIANA WILDCAT FAILURES

Daviess County: C. E. Leneff 1 Gill-Smoot et al, NE SW SE 29-2n-6w, dry, TD 2,263 ft.

Sunlight Coal Co. 1 Knepp, NE NE NE 1-3n-6w, dry, TD 748 ft.

Sunlight Coal Co. 1 Schrock et al, NW SE SE 1-3n-6w, dry, TD 735 ft.

Sunlight Coal Co. 1 Beck, SW SW NW 10-1s-5w, dry, TD 770 ft.

Sunlight Coal Co. 1 Blessinger, NW SW NW 30-2s-4w, dry, TD 817 ft.

Sunlight Coal Co. 1 Geisler, NE SE SE 14-2s-5w, dry, TD 846 ft.

Sunlight Coal Co. 2 Geisler, NE NE SE 14-2s-5w, dry, TD 872 ft.

Sunlight Coal Co. 1 Begle, NE NE NE 36-2s-5w, dry, TD 794 ft.

Gibson County: Ashland Oil & Refining Co. and Calvert Drilling, Inc., 1 Smith, SW SW NE 23-3s-12w, dry, TD 2,710 ft.

Knox County: S. D. Jarvis 1 Frick, SW SE NW 14-2n-8w, dry, TD 1,477 ft.

Pike County: W. J. Wheeler 1 Schafer, SW NW NE 30-1s-8w, dry, TD 1,640 ft.

Posey County: Skiles Oil Corp. 1 Wilson, NE NW NE 30-5s-13w, dry, TD 3,098 ft.

Sullivan County: Superior Oil Co. 1 Fuson, NW NW SW 29-9n-10w, dry, TD 2,587 ft.

T. & H. Corp. 1 DeHart, NE NW NW 36-9n-11w, dry, TD 2,604 ft.

Warrick County: T. C. Mullens 2 Ruth Mullens, SE SE NE 22-5s-8w, dry, TD 1,826 ft.

Sunlight Coal Co. 1 Mabeth, NE NW SW 12-6s-8w, dry, TD 1,673 ft.

Sunlight Coal Co. 1 Eble, SE SE NW 26-6s-8w, dry, TD 1,637 ft.

WESTERN KENTUCKY SUCCESSFUL WILDCATS

Hopkins County: George Hoffman 1 C. Combs Community, NE NW SW 14-L-26, IP 240 bbl., Aux Vases 2,631-43 ft., TD 2,782 ft. (extension and new pay zone Pond River pool).

Webster County: Basin Drilling Co. 2 L. Royster, S½ NE SE SW 7-N-24, IP 100 bbl., McClosky 2,526-38 ft., TD 2,570 ft. (extension and new pay zone Pratt pool).

WESTERN KENTUCKY WILDCAT FAILURES

Daviess County: Stewart Coal & Oil Co. 1 Clark, NEc SE NW NE 10-N-31, dry, TD 960 ft.

Stewart Coal & Oil Co. 1 Hardesty, NW SW NE 11-N-31, dry, TD 960 ft.

Henderson County: J. B. Buchman and C. E. O'Neal 1 King, S½ NW NE SE 17-O-24, dry, TD 2,612 ft.

Joe Reznik 1 Denton, N½ SE NW NW 17-O-24 dry, TD 2,616 ft.

Webster County: Skiles Oil Corp. 1 Casner, SEc NE NE SE 13-M-23, dry, TD 2,784 ft.

Producers Pipe Line Co. et al 1 Melton, SEc NE NW NW 4-M-26, dry, TD 2,692 ft.

MICHIGAN WILDCAT FAILURES

Allegan County, Heath Township: P. K. Degenther D-3 U. S. A., SW SE SE 22-3n-14w, Traverse 1,455 ft., dry, TD 1,499 ft.

Overisel Township: Smith Petroleum Co. 1 Brower, SW SE NW 12-4n-14w, Traverse 1,615 ft., dry, TD 1,619 ft.

Clare County, Redding Township: C. W. Collin 1-A State-Redding, NE SW NE 20-19n-6w, Dundee 3,854 ft., dry, TD 3,940 ft.

Ogemaw County, Edwards Township: Basin Oil Co. 1 Durham, NE SW NW 23-21n-1e, dry in all zones through the Sylvania, TD 5,260 ft.

Van Buren County, Geneva Township: Norman L. Stevens 1 Kochis, NE SW SE 26-1s-16w, Traverse 1,088 ft., dry, TD 1,097 ft.

Hartford Township: Max Spidel 1 Coughlin, NE SE NW 4-3s-16w, Traverse 975 ft., dry, TD 988 ft.

Rocky Mountain Area

(Continued from page 403)

Co. 1 Bayers, C NW SW 18-3s-5w; 833 ft., TD 835 ft.; shut down.

WESTERN NEBRASKA WILDCAT SUCCESS

Deuel County, West Big Springs: Ohio Oil Co. 1 "B" Troelstrup, NE NE SW 26-13n-43w, TD 3,415 ft.; IP: flowed 2,250 M.c.f. gas per day; Niobrara 2,508 ft., Ft. Hays 2,890 ft., Carlile 2,961 ft., Greenhorn 3,075 ft., "D" sand 3,214 ft., "G" sand 3,320 ft., "J" sand 3,379 ft.

WESTERN NEBRASKA WILDCAT FAILURE

Grant County: S. D. Johnson 1 Chris Abbott, C NE NE 12-23n-41w, TD 4,874 ft.; dry. Niobrara 2,118 ft., Ft. Hays 2,368 ft., Carlile 2,485 ft., Greenhorn 2,642 ft., first sand 2,844 ft., Skull Creek 3,195 ft., Dakota 3,280 ft., Morrison 3,560 ft., Sundance 3,752 ft., Pennsylvanian 4,609 ft.

NORTHERN NEW MEXICO WILDCAT FAILURE

Sandoval County: Southern Union Gas Co. 1 Jicarilla Tribe, NW SE NE 26-23n-4w, TD 4,918 ft., dry; Kirtland 2,320 ft., Pictured Cliffs 2,617 ft., Lewis 2,680 ft., Cliffhouse 4,070 ft., Menefee 4,130 ft., Point Lookout 4,600 ft.

SOUTH DAKOTA WILDCAT FAILURE

Perkins County: Shell Oil Co. 1 J. T. Homme, C NW SE 13-20n-12e, TD 9,348 ft.; dry. Niobrara 2,775 ft., Greenhorn 3,455 ft., Muddy 4,013 ft., Dakota 4,265 ft., Morrison 4,478 ft., Piper lime 4,910 ft., Spearfish 5,023 ft., Minnehahta 5,255 ft., Big Snowy 5,760 ft., Charles 6,054 ft., Madison 6,460 ft., Lodgepole 6,845 ft., Englewood 7,255 ft., Devonian 7,310 ft., Silurian 7,620 ft., Stony Mountain 7,970 ft., Red River 8,042 ft., Winnipeg green shale 8,645 ft., Cambrian 8,737 ft., pre-Cambrian 9,328 ft.

ADVERTISERS IN THIS ISSUE

Aerotec Corporation, The 72
Aetna Ball and Roller Bearing Company 37
Air Reduction Magnolia Company 20
Ajax Iron Works 24
Aldrich Pump Co., The 155
Allis-Chalmers Mfg. Co. 133
Allis-Chalmers Mfg. Co. (Tractor Division) 119
Altens Foundry & Machine Works 388
Aluminum Co. of America 85
American Car and Foundry Company 327
American Hoist and Derrick Company 371
American Iron & Machine Works Co. 163
American LaFrance-Foamite Corp. 107
American Locomotive Company 71
American Meter Company 79
American Optical Company 77
American Pipe & Steel Corporation 146
American Recording Chart Co. 244
Ampco Metal, Inc. 231
Anchor Petroleum Company 168
Anderson Co., V. D. 377
Anglo-Iranian Oil Company, Limited 360
Ansul Chemical Co. 258, 268
Armstrong Machine Works 102
Associated Oil Field Rentals, Inc. 277
Attapulgus Clay Company 40
Axelson Manufacturing Company 315
Babcock & Wilcox Tube Company 44, 45
Badger Manufacturing Co. 358
Baker Oil Tools, Inc. 214, 215, 336, 400
Bank of Montreal 242
Baroid Sales Division, National Lead Company 18
Barrett Division of Allied Chemical & Dye Corp. 28
Beacon Petroleum Company 225
Bechtel Corporation 19
Bell Rubber Co. 396
Bendix Aviation Corporation 75
Bethlehem Steel Co. 1
Bingham Pump Co. 42
Black, Sivalls & Bryson, Inc. 213
Blaw-Knox Construction Company 70
Bonney Forge & Tool Works 30
Bovaird Supply Co., The 399
Boyles Galvanizing Company 299
Brewster Company, Inc., The 221
Bristol Company, The 31
Brown Fintube Co., The 74
Bucyrus-Erie Co. 137
Buda Company, The 275
Byron Jackson Co. Front Cover, 115, 374, 397
Cameron Iron Works, Inc. 50
Canadian Bank of Commerce, The 256
Canton Cast Products Co. 356
Cardwell Mfg. Co., Inc. 382, 383
Caterpillar Tractor Co. 10
Chapman Valve Mfg. Co., The 80
Chase Brass & Copper Co. 63
Chemical Construction Corporation 43
Chicago & Southern Air Lines 315
Chilean Consulate 377
Clark Bros. Co., Inc. 16, 17
Classified Advertising 412, 413, 414, 415, 416
Claymont Steel Corporation, Subsidiary of The Colorado Fuel and Iron Corporation 56
Consolidated Engineering Corporation 398
Continental Electric Co., Inc. 373
Continental Motors Corp. 99
Continental Supply Co., The 87, 88
Cooper-Bessemer Corp., The 210, 211
Cooper, Inc., Fred E. 247
C-O-Two Fire Equipment Company 381
Crane Co. 5
Crosse Manufacturing Co., Inc., M. J. 362
Cummins Engine Co., Inc. 65
Curtin & Co., W. H. 372
Cutler-Hammer, Inc. 100
Davis Regulator Co. 333
Dean Brothers Pumps, Inc. 367
Dean Hill Pump Company 86
Delta Engineering Sales Co. 376
Detroit Diesel Engine Division, General Motors Corp. 96
Diamond Power Specialty Corp. 13
Dominion Bridge Company, Limited 89
Dow Chemical Co., The 125
Dresser Industries, Inc. 16, 17
Drilling & Service, Inc. 393
Duff-Norton Mfg. Co. 255
du Pont 53, 54
Durabla Manufacturing Company 111
Eagle-Picher Sales Co. 227
Eastman Oil Well Survey Company 145
Eaton Manufacturing Company, Axle Div. 253
Empire Trust Company 380
Emsco Derrick & Equipment Co. 87, 88
Everlasting Valve Company 301
Farrel-Birmingham Co., Inc. 76
Farris Engineering Corp. 116
Federated Metals Division, American Smelting and Refining Company 367
Fisher Research Lab., Inc. 372
Flexitallic Gasket Company 233
Flint Steel Corporation 298
Floridin Company 358
Foster Cathead Company 306
Foster Engineering Company 394
Foster Wheeler Corp. 121, 122
Franks Machine Co. 293
Frontier Chemical Company 254
Fuller Company 120
Fulton-Syphon Division Robertshaw-Fulton Controls Co. 15
Gardner-Denver Company 128
Gaso Pump & Burner Mfg. Co. 159
General Electric Company 8, 9
General Electric Co., Electronic Dept. 64
Geolograph Company, Inc., The 333
Gilmer Company, L. H. 276
Glitsch & Sons, Inc., Fritz W. 289
Goodrich Company, B. F. 3
Goulds Pumps, Inc. 405
Grancell, I. H. 371
Graver Tank & Mfg. Co., Inc. 103
Griffenhagen & Associates 274
Griscom-Russell Co., The 112, 113
Guiberson Corporation 271
Gunite Concrete & Construction Co. 376
Haering & Co., Inc., D. W. 243
Halliburton Oil Well Cementing Co. 11, 69
Harnischfeger Corp. 132
Harrisburg Steel Corporation 290
Hewitt Rubber Division, Hewitt-Robins, Incorporated 385
Hilliard Corporation, The 389
Homestead Valve Manufacturing Co. 123
Houston Contracting Company 365
Hudson Engineering Corporation 354
Hughes Tool Co. Back Cover
Hutchison Manufacturing Co. 333
Independent Exploration Co. 101
Inferno Co., The 364, 375
Inflico Incorporated 143
Ingersoll-Rand 138
International Nickel Company, Inc., The 129
Johns-Manville Corporation 285
Johnson-Fagg Engineering Company 328
Johnston & Jennings Company, The, Division of Pettibone Mulliken Corporation 400
Johnston Oil Field Service Corp., M. O. 402
Jones & Laughlin Steel Corp. 104
Jones & Laughlin Supply Co. 55
Jones Company, The S. M. 46
Joy Manufacturing Company 29
Justrite Mfg. Co. 405
Kaar Engineering Co. 376
Kelly Company, Ben F. 373
Kellogg Co., The M. W. 33, 34, 35, 36
Ken Corporation 279
Kennametal Inc. 157
Kidde & Company, Inc., Walter 26
Kinney, Inc. 156
Kinzbach Tool Co., Inc. 397
Ladish Co. 235
Landis Machine Co., The 7
Lane-Wells Company 14, 140
Laughlin Co., The Thomas 387
Layne & Bowler, Inc. 127
LeBus International Engineers Limited 210, 219
Le Roi Company 48, 49
Linde Air Products Company, A Division of Union Carbide and Carbon Corporation 151
Lucey Export Corp. 98
Lucey Products Corporation 153
Lufkin Foundry & Machine Co. 22
Lummus Co., The 51
Lunkenheimer Co., The 27
Magnet Cove Barium Corp. 62
Maintenance Engineering Corp. 131
Manhattan Rubber Division, Raybestos-Manhattan, Inc. 47
Manning, Maxwell & Moore, Inc. 95
Manzel 283
Marine Exploration Company 401
Marlow Pumps 363
Marsh Instrument Co. 90
Martin & Company, Chas. 318
Martin, John N. 373
McCord Corporation 300
McCullough Tool Company 304
McKissick Products Corporation 302
McNamar Tank & Boiler Co. 234
Mercoid Corp., The 286
Mid-Continent Supply Company 68
Midwest Piping & Supply Co., Inc. 21
Minneapolis-Honeywell Regulator Co., Industrial Division 58, 59
Minneapolis-Moline 346
Mission Mfg. Company 303
Moore Corporation, Lee C. 378
Murphy Diesel Company 2
Nash Engineering Co. 150
National Airoil Burner Co., The 368
National Aluminate Corp. 209
National Bank of Tulsa 139
National Tank Company 418
National Tube Company 52
Nelson Electric Mfg. Co. 356
Nelson Electric Supply Co. 392
Nichols Company, Inc., S. W. 375
Nicolet Industries, Inc. 365
Nordstrom Valve Division, Rockwell Manufacturing Company 161
Norris Manufacturer, Inc., W. C. 166
Oakite Products, Inc. 78
Ohio Injector Company 23
Oil and Gas Journal, The 356
Oil Center Tool Co. 84
Oil Well Mfg. Corp. 307
Oil Well Supply Co. 4
Orbit Valve Company 294
Overstrom & Sons 392
Pacific Coast Borax Co. 223
Page Fence Association 231
Paris Distributor, Inc., Henry H. 389
Parkersburg Rig & Reel Co. 142
Peerless Mfg. Co. 144
Pelican Well Tool & Supply Co. 397
Pelton Water Wheel Co. 388
Penberthy Injector Co. 236
Perrault Brothers 364, 392
Petro-Chem Development Co., Inc. 226
Petroleum Electric Power Association 39
Petroleum Rectifying Company 136
Petty Geophysical Engineering Company 284
Pipe Line Service Corp. 165
Pittsburgh Plate Glass Company, Industrial Paint Division 110
Procon Incorporated 141
Pyrene Manufacturing Company 403
Quaker Oats Company, The 114
Rasmussen Mfg. Co. 367
Ratigan, Inc., J. P. 149
Raybestos-Manhattan, Inc., Manhattan Rubber Division 47
Raybestos-Manhattan, Inc., Packing Div. 66
Read Standard Corporation 245
Rector Well Equipment Co., Inc. 94, 372
Reda Pump Company 283
Reed Roller Bit Company Inside Front Cover
Reilly Tar & Chemical Corp. 269
Republic Exploration Co. 384
Republic Steel Corporation 38
Ridge Tool Company, The 158
Robbins & Myers, Inc. 241
Rockwood Sprinkler Co. 105, 147
Rolo Manufacturing Co. 258
Royal Bank of Canada, The 248
Rust-Oleum Corporation 162
Safety First Products Corp. 291
Sawyer & Son Co., The H. M. 282
Schlumberger Well Surveying Corp. 253
Seismograph Service Corp. 309
Shaffer Tool Works 283
Shand & Jurs Co. 152
SIE Metal Fabricating Company 217
Skinner Company, M. B. 376
Smith Corporation, A. O. 97
Smith Oil Tool Co., H. C. 170
South Texas National Bank 258
Southern Mill & Mfg. Co. 108
Spang & Co. 73
Spencer-Safford Loadcraft, Inc. 389
Sperry-Sun Well Surveying Co. 109
Standco Brake Lining Co. 372
Starrett Company, The L. S. 372
Stoody Company 6
Sun Shipbuilding & Dry Dock Company 117
Tapecoat Company, The 248
Technical Oil Tool Corp., Ltd. 61
Tennessee Eastman Company 164
Thermoid Company 60
Thomas Flexible Coupling Co. 317
Thompson Tool Co. 278
Thornhill-Craver Co. 251
Timken Roller Bearing Company Steel & Tube Division 67
Treiolite Company 57
Tripplehorn Co., The 368
Tubing Appliance Co. 405
Tubular Micrometer Co. 154
Union Carbide and Carbon Corporation, Linde Air Products Company 151
Unit Rig & Equipment Co. 81
United Geophysical Company 391
United States Rubber Company 32
United States Steel Supply Company 4, 52
United Supply & Manufacturing Co. 331
Van Dyke Industries 392
Vapor Recovery Systems Co., The 134, 135
Victaulic Co. of America 160
Victor Equipment Company 237
Vogt Machine Co., Henry 25
Voss Co., Inc., J. H. H. 366
Wagner Electric Corporation 108
Wait Mfg. Co. 364
Warner Electric Brake & Clutch Company 92, 93
Warner Lewis Company 364
Watson-Stillman 286
Waukesha Motor Company 126
Weatherford Oil Tool Co., Inc. 82, 83
Welex Jet Services, Inc. 370
Well Equipment Mfg. Corp. 257
Well Surveys, Inc. 228
Western Geophysical Company 12
Westinghouse Electric Corp. 124
White, Weld & Co. 222
Whitmor Homebuilders, Inc. 148
Wickes Boiler Co., The 316
Williams Bros. Corp. 390
Wilson Manufacturing Co., Inc. 260
Winslow Engineering Co. 395
Wisconsin Motor Corporation 91
W-K-M Company 110
Wood's Sons Co., T. B. 364
Worthington Pump & Machinery Corp. 130
Youngstown Sheet and Tube Company Inside Back Cover
Zeligson Truck and Equipment Company 368

TABLE OF CONTENTS ON PAGE 169

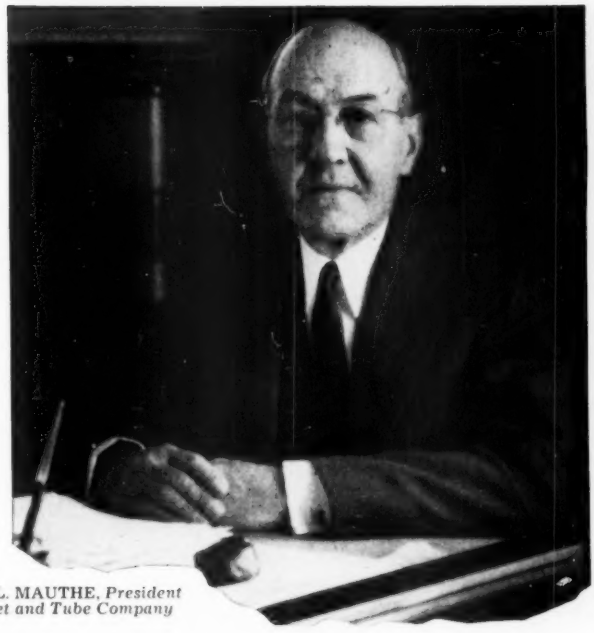
Greetings . . .

The management and employees of National Tank Company join in wishing you the season's best at Christmas and continuing prosperity throughout the New Year.

We want to express our humble gratitude for the one-quarter century of faith and confidence our patrons have expressed in us by their evaluation of what we have to offer. Our gratitude can best be expressed by our continued research program and development, production and service of newer, better equipment for the petroleum, chemical and manufacturing industries.

NATIONAL TANK COMPANY

Why is the **scrap** situation so **critical?**



An interview with J. L. MAUTHE, President
The Youngstown Sheet and Tube Company

Why are you concerned about iron and steel scrap, Mr. Mauthe?

Our inventories are critically low and the present scrap flow is not sufficient to maintain capacity steel plant operations. Furthermore, if the flow of scrap is not increased, a curtailment of steel production is inevitable.

The industry is using all the pig iron and all the home scrap that is available. The balance of our metallic requirements must be made up through procurement of purchased scrap. Every ton of scrap that we do not get represents a ton of steel that we cannot make.

How much scrap does the industry need?

In 1950, 96,700,000 tons of steel ingots and castings were produced, requiring over 61,000,000 tons of iron and steel scrap.

In 1951, over 65,000,000 tons of scrap will be required, and even more will be needed in 1952.

Where does scrap come from?

About 58% of the total scrap required is produced by the ingot and casting makers, and is known as "home" scrap; the balance of 42% is "purchased" scrap and is procured from outside sources.

Purchased scrap generally falls into two categories: Scrap from current fabrication and that which is the result of obsolescence.

There are three important sources from which we get obsolete scrap, much of which is dormant:-

1 - Obsolete machinery and equipment in every industrial plant, at the oil fields and on the farms.

2 - Battlefield scrap, obsolete ships and war material, surplus machinery and equipment, which government can make available.

3 - Countless old automobiles and trucks, which are rusting away in automobile wrecking yards in every section of the country.

What can be done to increase tonnage of purchased scrap?

This scrap must be made available immediately! All industry and government must awaken to the critical nature of the situation. They must realize that if we do not get the scrap, they will not get the steel!

YOU CAN HELP - YOU MUST HELP!
NO SCRAP - NO STEEL

QUALITY · YOUNGSTOWN · SERVICE

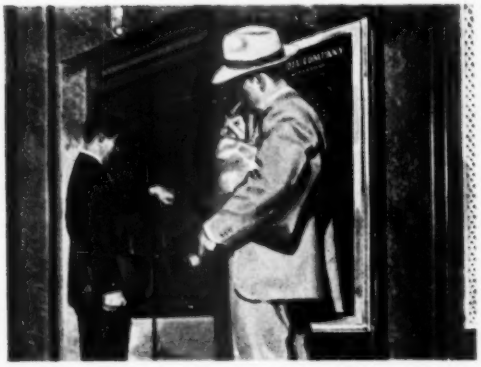
The Youngstown Sheet and Tube Company - Youngstown, Ohio

The Right Bits When You Need Them!

It's no accident that your local Hughes field representative delivers the *right rock bits on your rig at the right time!*

The effort of the entire Hughes organization is directed toward knowing, in advance, the bit requirements of each field, in order to set up manufacturing schedules to meet those requirements.

This means knowing the types and sizes of bits needed and approximately when they will be required, based on the casing sizes in general use and likely to be used...formations being encountered...bits making the best footage...and the depth and number of wells to be drilled.

This information comes from many sources. Its accuracy is made possible by the co-operation of every segment of the drilling and producing industry and accounts for the fact that Hughes is able to anticipate the bit needs of the industry.

HUGHES Tri-Cone ROCK BITS